Parani-BCD110V3

User Guide

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Version 3.0.1

Parani-BCD110V3 User Guide

Version 3.0.1
Firmware version 3.0.X
Printed in Korea

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Trademark

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Notice to Users

When a system failure may cause serious consequences, protecting life and property against such consequences with a backup system or safety device is essential. The user agrees that protection against consequences resulting from system failure is the user's responsibility.
This device is not approved for life-support or medical systems.
Change or modifications to this device not explicitly approved by Sena Technologies will void the user's authority to operate this device.

Precautions and Safety

Electricity
Use only within the Parani-BCD110V3 power specification. Use Under incorrect power specification may result electrical shock and damage of the product.

Product
Parani-BCD110V3 supports the TTL-level UART function. Do not connect with non-compatible products. Damage to your products may result from improper use. Do not drop or subject the device to impact. Damage to your products may result from improper use. Keep away from harsh environments including humid, dusty, and smoky areas. Damage to your products may result from improper use. Do not use excessive force on the buttons or attempt to disassemble the device. Damage to your products may result from improper use. Do not place heavy objects on the product. Damage to your products may result from improper use.

Technical Support

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Revision History

Revision	Date	Name	Description
V3.0.0	2013-09-30	TM Kim	Initial Release
V3.0.0.1	2014-03-24	TM Kim	Modify incorrect descriptions
V3.0.1	2014-12-02	TM Kim	V3.0.1 Release

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1. Introduction

1.1. Overview

The Parani-BCD110V3 is Bluetooth OEM SMD/DIP module combining antenna for OEM manufactures who want to implement Bluetooth functionality with their products cost effectively and also in timely manner. Parani-BCD110V3 has a built in antenna to lower the overall cost while benefit from the Parani-BCD110V3's field-proven standard SPP firmware provided with no additional cost. In addition, it is provided with the firmware used for Sena I/O (Input/Output) profile and SCO (synchronous Connection Oriented) connection.

The Parani-BCD110V3 supports Class1 Bluetooth transmission level for longer communication distance typically ranges from 200m up to 1000m.

The Parani-BCD110V3 is provided with the firmware which not only conforms to Bluetooth v2.0+EDR but also supports SPP (Serial Port Profile), Sena I/O Profile and SCO connection by default. The SPP firmware supports up to 7 simultaneous multiple connection which can compose the maximum Bluetooth piconet and is designed to work out-of-box for real world SPP applications such as POS (point-of-sales), industrial automation, remote metering and other various applications. Sena I/O Profile can be applied for remote controller or temperature/light control system without any additional interface by supporting DIO input/output and AIO input. In addition, SCO connection facilitates the implementation of Bluetooth voice communication using starter kit and simple PCM interface mentioned at Appendix F.

Optionally, the Parani-BCD110V3 can be supplied with only software stack up to HCI level so entire Bluetooth stack runs on the host side for the application such as USB dongles for computers. Besides, OEM manufacturers can even develop and embed their own firmware into the Parani-BCD110V3.

The Parani-BCD110V3 is fully qualified with Bluetooth v2.0+EDR specification so OEM manufacturers can save cost and time for overall OEM product certifications, which makes the Parani-BCD110V3 ideal solution for larger volume and cost sensitive applications.

This document deal with the introduction, configuration and directions of the Parani-BCD110V3 module.

1.2. Product Specification

	Parani-BCD110V3
Bluetooth specifications	Bluetooth v2.0 + EDR
	Class1
	Profile: SPP(*Serial Port Profile*), Sena I/O Profile
	Working distance: By default antenna is 200m (0.12 mile), Supports up to 1000m (0.62 mile)
Transmit Power	+18dBm Typical
Receive Sensitivity	-90dBm (0.1% BER)
Frequency range	2402 MHz – 2480 MHz
Serial Interface	Serial UART speed up to 921.6kbps CTS/RTS flow control, DTR/DSR for loop-back & full transfer
I/O Interface	5 DIO, 2 AI
PIN Interface	BCD110Sx: 1.27mm SMD Pad 18 x 2 (36pin) BCD110Dx: 1.27mm Pin Header 18 x 2 (36pin)
USB Interface	V2.0
Configuration	ParaniWIN, Modem AT command set
Firmware Update	ParaniUpdate
Power	Nominal: 70mA@3.3VDC Maximum: 150mA@3.3VDC (200mA@3.3VDC in Test Mode
Environmental	Operating temperature : -40 ~ 80 °C Storage temperature: -40 ~ 85 °C Humidity: 90% (Non-condensing)
Physical Properties	Parani-BCD110V3 Dimension DIP type 34.6 x 16.8 x 7.5 mm (0.661 in x 1.362 in x 0.295 in) SMD type 34.6 x 14.8 x 3.0 mm (1.362 in x 0.583 in x 0.118 in)

	Weight Parani-BCD110SC: 2g Parani-BCD110SU: 2g Parani-BCD110DC: 3g Parani-BCD110DU: 3g Parani-BCD110DS: 4g
Approvals	FCC, CE, IC, KC, TELEC, SIG
Warranty	1-year limited warranty



Note *:

Bluetooth v2.0 supports improved AFH function. AFH function is to mitigate the interference between WiFi and Bluetooth radios by automatically avoiding the active WiFi channel from Bluetooth link. However, AFH dos not provide a complete solution making WiFi and Bluetooth work together in harmony. It is highly recommended for users to test their wireless system enough before deployment since the overall system performance is affected by various environmental factors such as distance between them.

2. Getting Started

2.1. Overview

This chapter describes how to connect the Parani-BCD110V3 to the Development Board and how to confirm that the Parani-BCD110V3 works well by communicating with the Parani-BCD110V3 by a Terminal Program.
The additional configuration of the Parani-BCD110V3 is explained at the next chapter in detail. Moreover, the configuration of SPP, Sena I/O Profile and SCO is treated with examples at the following chapters.

Following steps are taken to ensure the constitution and the operation of the Parani-BCD110V3.

- Go through the package check list.
- Connect the Parani-BCD110V3 to the Development Board according to the panel layout of the Development Board.
- Connect the power and the serial data cable to the Development Board and confirm the normal operation.

Following items are pre-required to take steps for ensuring the constitution and the operation of the Parani-BCD110V3.

- One Development Board (included in the Starter Kit package).
- One DC Power adapter or USB power cable (included in the Starter Kit package).
- One Serial console cable for configuration (included in the Starter Kit package).
- One PC with RS232 serial port.
- Terminal emulation program running on the PC.

2.2. Package Check List

2.2.1. Unit Package

- BCD110SC – Bluetooth embedded OEM module SMD Type, Class 1 w/ chip antenna
- BCD110SU – Bluetooth embedded OEM module SMD Type, Class 1 w/ U.FL connector
- BCD110DC – Bluetooth embedded OEM module DIP Type, Class 1 w/ chip antenna
- BCD110DS – Bluetooth embedded OEM module DIP Type, Class 1 w/ SMA connector
- BCD110DU – Bluetooth embedded OEM module DIP Type, Class 1 w/ U.FL connector

2.2.2. Starter Kit

- BCD110DC 1
- BCD110DS 1
- BCD110DU 1
- Development board 1
- DC Power adapter 1
- RS232 serial cable 1
- Stub antenna 1

- 3dBi Dipole antenna 1
- U.FL Cable 1

2.3. Panel Layout

This section describes the panel layout of the Development Board.

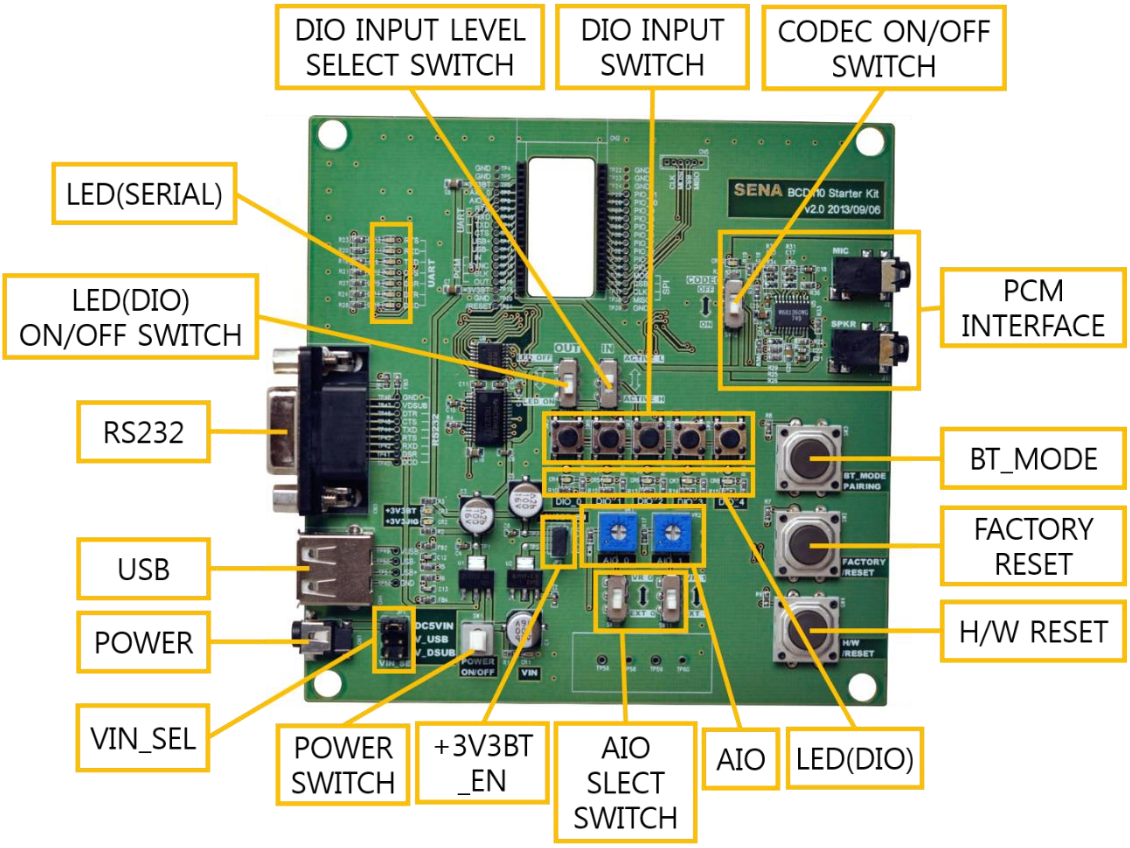


Figure 2-1 The Panel Layout of BCD Development Board

- VIN_SEL – selects Power Input.
- AIO SELECT SWITCH – selects external terminal or variable resistor as AIO input.
- AIO – checks changes in the AIO input value by changing the value of the variable resistor.
- PCM INTERFACE – is used for SCO connection which enables voice communication to the degree of cellular phone.
- CODEC ON/OFF SWITCH – selects whether to use PCM INTERFACE.
- DIO INPUT SWITCH – determines DIO value.
- DIO INPUT LEVEL SELECT SWITCH – selects ACTIVE LOW or ACTIVE HIGH as the operation of DIO INPUT SWITCH. Pressing the DIO INPUT SWITCH inputs Low signal in ACTIVE LOW and High signal in ACTIVE HIGH.
- LED(DIO) ON/OFF SWITCH – selects whether LED(DIO) operates.
- USB – is available only on HCI firmware.

2.4. Connecting the Hardware

This section describes how to connect the Parani-BCD110V3 to the Development Board and the Development Board to the serial device for initial testing.

- Connect the Parani-BCD110V3 to the Development Board.
- Connect a power source to the Development Board for the Parani-BCD110V3.
- Connect the Development Board for the Parani-BCD110V3 to a serial device.

2.4.1. Connecting Parani-BCD110V3 to Development Board

Connect the Parani-BCD110V3 to the Development Board as shown below.

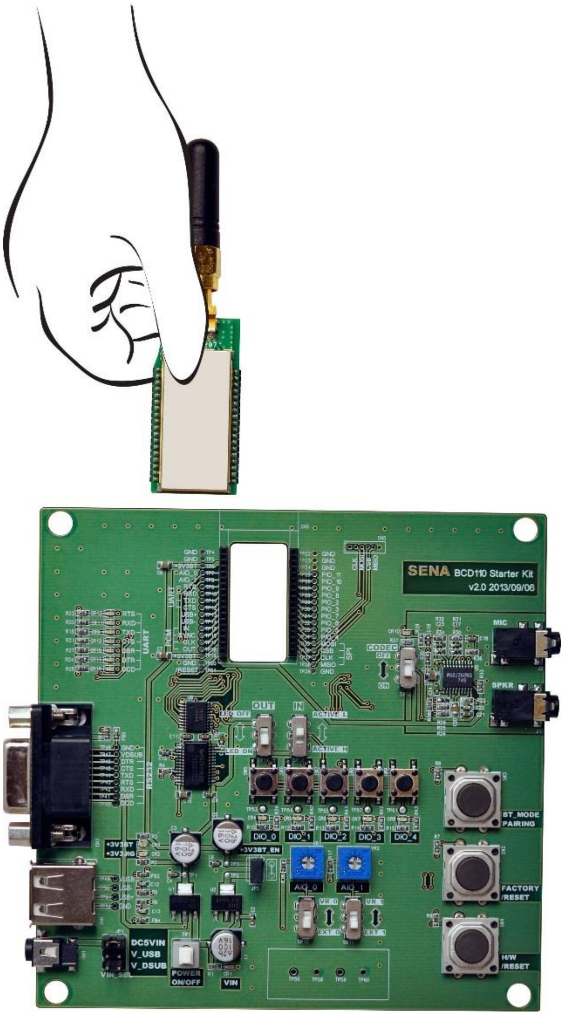


Figure 2-2 Connecting Parani-BCD110V3 to Development Board

2.4.2. Connecting Power to Development Board

Connect the power plug to the power connector of the Development Board for the Parani-BCD110V3 using the DC power adapter or USB power cable that is included in the package.

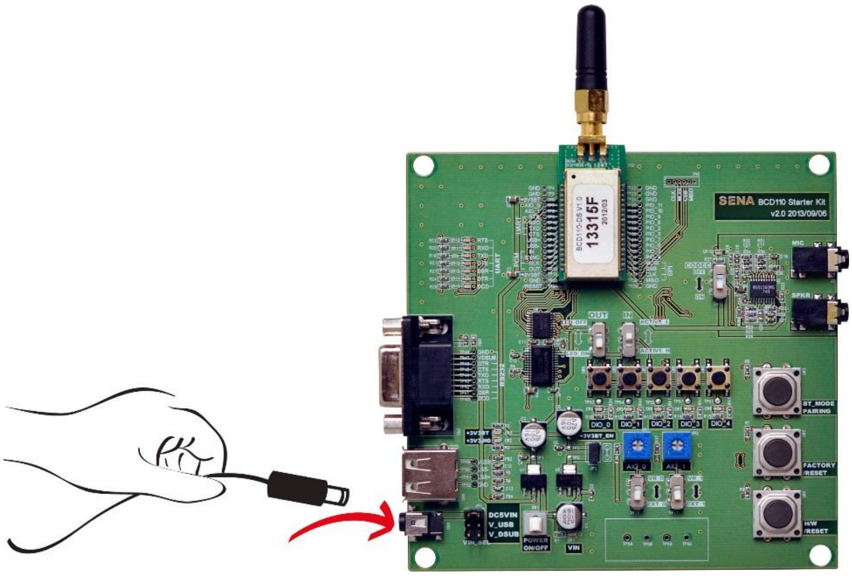


Figure 2-3 Connecting Power to Development Board

2.4.3. Connecting a Device to Development Board

Connect the Serial Data cable between the Development Board and the serial device. If necessary, supply power to the serial device attached to the development Board.

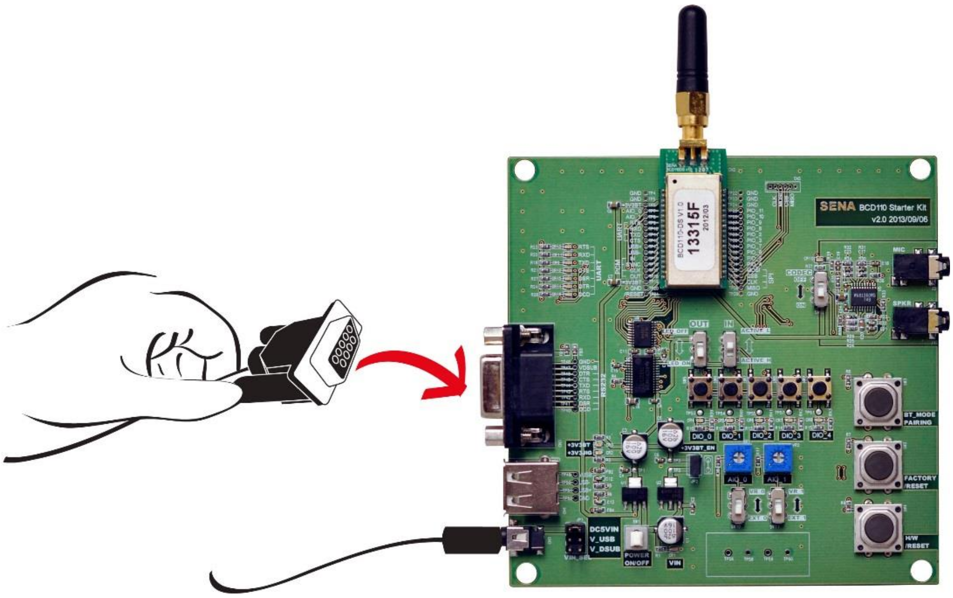


Figure 2-4 Connecting a Device to Development Board

2.5. Confirming Normal Operation

Once the hardware installation is completed, you can input AT commands to the Parani-BCD10_V3 through a Terminal Program on PC. Any Terminal Program is available in this case. In this document, it is assumed that the Hyper Terminal is used. Windows Vista or Windows 7 does not include the Hyper Terminal but it is possible to download it through the internet. Please refer to the Microsoft web page for more details.

Once the HyperTerminal is installed, launch HyperTerminal and select the serial port that is connected to the Parani-BCD110V3 development board and enter the serial setting to use. The default serial settings of the Parani-BCD110V3 are 9600 bps, 8 data bit, none parity, 1 stop bit, hardware flow control.

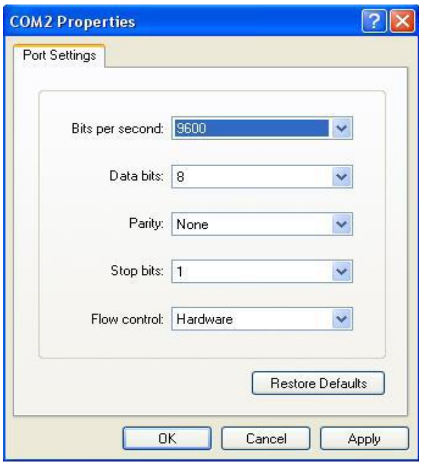


Figure 2-5 HyperTerminal Serial Setting

To display the AT commands that are being typed, you need to enable the local echo option on the HyperTerminal. To enable this option, Go to File->Properties->Settings->ASCII setup and select the "Echo typed characters locally" option. To verify the connection, type AT and press the Enter key. If the AT command is accepted by the Parani-BCD110V3, OK string will be displayed on the screen.

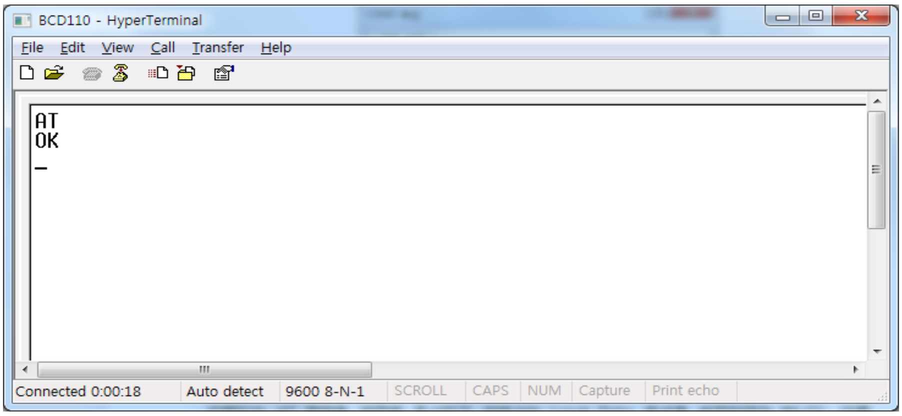


Figure 2-6 Testing AT Command on HyperTerminal

3. Configuration

3.1. Overview

As mentioned at Chapter 2, the Parani-BCD110V3 is configured and operated using serial port. This section includes the serial port settings out of the basic configurations. It also refers to how to configure the remote device through SPP connection. In addition, it deals with configuring the four operation mode, establishing the SPP connection and updating the firmware with certain utility software.

3.2. Serial Ports

The applicable settings for serial ports are as follows. Not listed in the table below, settings are not supported for the Parani-BCD110V3.

Table 3-1 The Parani-BCD110V3 Serial Port Settings

Serial Port Settings	Values
Baud rate	1200, 2400, 4800, 9600, 14400, 19200, 38400, 57600, 115200, 230400, 460800, 921600
Data bite	8
Parity	No parity, Even parity, Odd parity
Stop bit	1, 2
Hardware Flow Control	Use, No Use

* The values in box are the factory default settings.

3.3. Data Bit

The Parani-BCD110V3 supports only 8 data bit. But if both master device and slave device are one of Parani-SD, Parani-ESD or Parani-BCD or Parani-MSP1000 series, Parani series devices can support 7 data bit and even/odd parity by setting both Parani series devices to 8 data bit and none parity. But 7 data bit and none parity cannot be supported even if both master device and slave device are Parani series devices.

3.4. Hardware Flow Control

The Parani-BCD110V3 plugged into its host system transmits data from host to the other side Bluetooth device. This data is saved temporarily in the internal buffer of Parani-BCD110V3 and sent repeatedly until the transmission is completed packet by packet. When the radio transmission condition is not good enough to send data promptly, it can cause a transmission delay. If the host sends more data when the buffer is full, buffer overflow will make Parani-BCD110V3

malfunction consequently. In order to prevent this buffer overflow, Parani-BCD110V3 works as follows.
When using hardware flow control, Parani-BCD110V3 disables RTS so that it stops receiving any further data from the host when the buffer becomes full. RTS will be re-enabled again to begin receiving data from the host when the buffer has created more room for more data.
When hardware flow control is not being used, the Parani-BCD110V3 clears the buffer to secure room for the next data when the buffer becomes full. This can mean a loss of data may occur. As the transmission data becomes large, the possibility of data loss becomes greater.
For large data transmissions, the use of hardware flow control is highly recommended. (Not support flow control in Multi-Drop Mode.)

3.5. Remote Configuration Mode

The Parani-BCD110V3 supports remote configuration mode. After connecting the Parani-BCD110V3 through Bluetooth, send three remote escape sequence character (default: '-', 45) for remote configuration mode. Then, the Parani-BCD110V3 will enter remote configuration mode. You have to enter the password with "AT+PASS" command. The default password is "0000".
After the password authentication, the remote configuration of the Parani-BCD110V3 is available with the "Remote Configuration Enabled" message displayed. After password authentication fails three times, remote configuration mode will close. If there is no input for two minutes after entering remote configuration mode, remote configuration mode will also close. (However, if periodic sampling or change detection sampling is active, auto close function of the remote control mode will be inactive.)
The password for remote configuration mode is configurable using "AT+CHPASS" command. Its maximum length is 8. If it is not set, remote configuration mode is not available.

AT+CHPASS=<values><CR>

* AT commands such as "ATH", "ATO", "ATD", "AT+BTSCAN", "AT+BTINQ?", "AT+BTCANCEL", "AT+IOCONNECT", "AT+IODISCONNECT", "AT+SCOCONNECT", "AT+SCODISCONNECT" are not performed at remote configuration mode.

Example of remote configuration mode

```
CONNECT 00019520070E
---

?Please Enter Password
at+pass=0000

OK

Remote Configuration Enabled
at+btinfo?

000195000001,BCD110v3.0.1-095515,MODE0,CONNECT,0,0,HWFC

OK
```

3.6. Software and Utility

This configuration software and utility for firmware update is included with the product, which also can be downloaded from http://www.sena.com.

Table 3-2 Configuration Software

Software	Purpose	Operating System
ParaniWIN	Configuration	MS Windows 98SE or Higher
ParaniUpdater	Firmware Update	MS Windows 98SE or Higher

3.6.1. ParaniWIN

ParaniWIN is a program that runs on Microsoft Windows for the configuration of Parani-BCD110V3. Before configuring Parani-BCD110V3 with ParaniWIN, user needs to know Bluetooth connection modes and Parani-BCD110V3 operation modes as following.

A Bluetooth device can play a role as a master or slave. Master tries to connect itself to other Bluetooth devices, and slave is waiting to be connected from other Bluetooth devices. A Bluetooth connection is always made by a pair of master and slave devices. There are two modes in slave, Inquiry Scan or Page Scan mode. It can be in both or either of them. It waits for a packet of inquiry from other Bluetooth device in Inquiry Scan mode and waits for a packet of connection from other Bluetooth device in Page Scan mode. Every Bluetooth device has its unique address, called BD (Bluetooth Device) address, which is composed of 12 hexa-decimal numbers.

To utilize these two Bluetooth connection mode efficiently, Parani-BCD110V3 supports four operation modes as in table 3-3.

Table 3-3 The Parani-BCD110V3 Operation Modes

Mode	Description
Mode0	Parani-BCD110V3 is directly controlled by AT commands. Parani-BCD110V3 does not anything when power on or software reset and waits for AT command input. Neither master nor slave is assigned to Parani-BCD110V3 in mode0. User can change the configuration parameters and perform functions such as search and connection through AT commands in this mode. Parani-BCD110V3 must be in Mode0, when it is directly configured or controlled by AT commands. The factory default is set to Mode0.
Mode1	Parani-BCD110V3 tries to connect the last connected Bluetooth device. Parani-BCD110V3 in Mode1 is to be a master and tries to connect the last connected Bluetooth device in SPP and I/O profile. It also tries the SCO connection after SPP connection is established with SCO Enable (ATS84) enabled. Unlike SPP, I/O and SCO connection is available only in single connection mode. If the last connected Bluetooth device in SPP profile is different from the last connected Bluetooth device in I/O profile, Parani-BCD110V3 tries to connect to not the latter but the former in both SPP and I/O profile. Once Parani-BCD110V3 successfully connects to the target device in Mode0, it is possible to change the operation mode to Mode1 from Mode0. Parani-BCD110V3 stores the BD

	address of the Bluetooth device which is connected for the last time at specific S-registers such as ATS46, ATS54, ATS55, ATS56, ATS57, ATS58, ATS59 in SPP profile and ATS72 in I/O profile. Without direct connection to the target device in Mode0, it is possible to change to Mode1 by setting the S-register for the last connected device with AT command. When Parani-BCD110V3 is initially used or hardware reset is committed, there is no BD address stored in Parani-BCD110V3. In this case, it is impossible for Mode1 to work properly, so the mode change to Mode1 cannot be made. Parani-BCD110V3 in Mode1 cannot be discovered or connected by other Bluetooth devices.
Mode2	Parani-BCD110V3 waits for a connection from the last connected Bluetooth device. Parani-BCD110V3 in Mode2 is to be a slave and waits for the connection only from the last connected Bluetooth device in SPP and I/O profile. It also waits for the SCO connection after SPP connection is established with SCO Enable (ATS84) enabled. If the last connected Bluetooth device in SPP profile is different from the last connected Bluetooth device in I/O profile, Parani-BCD110V3 waits for connection from not the latter but the former in both SPP and I/O profile. Mode2 is available only in single connection mode. Once Parani-BCD110V3 successfully connects to the target device in Mode0, it is possible to change the operation mode to Mode2 from Mode0. Without direct connection to the target device in Mode0, it is possible to change to Mode2 by setting the S-register for the last connected device with AT command. When Parani-BCD110V3 is initially used or hardware reset is committed, there is no BD address stored in Parani-BCD110V3. In this case, it is impossible for Mode2 to work properly, so the mode change to Mode 2 cannot be made. Parani-BCD110V3 in Mode2 cannot be discovered by any other Bluetooth device nor connected to Bluetooth devices other than the last connected device whose BD address is stored at specific S-registers such as ATS46 in SPP and ATS72 in I/O profile.
Mode3	Parani-BCD110V3 waits for the connection from any other Bluetooth devices. In Mode 3 the Parani-BCD110V3 is discoverable and can be connected to by other Bluetooth devices.

Running ParaniWin, the Serial Port Setting window appears as below:

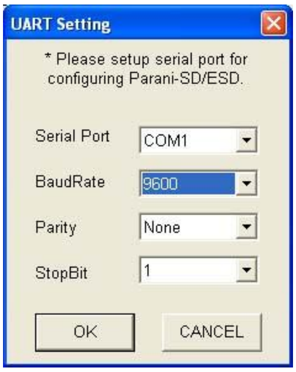


Figure 3-1 Serial Port Setting

Set each option properly and click [OK]. If the settings of the Parani-BCD110V3 are different from the ParaniWin, an error message will pop up. If the Parani-BCD110V3 is in the status of connection, warning message will pop up. Then the current connection can be canceled by [Disconnect] button on the main window.

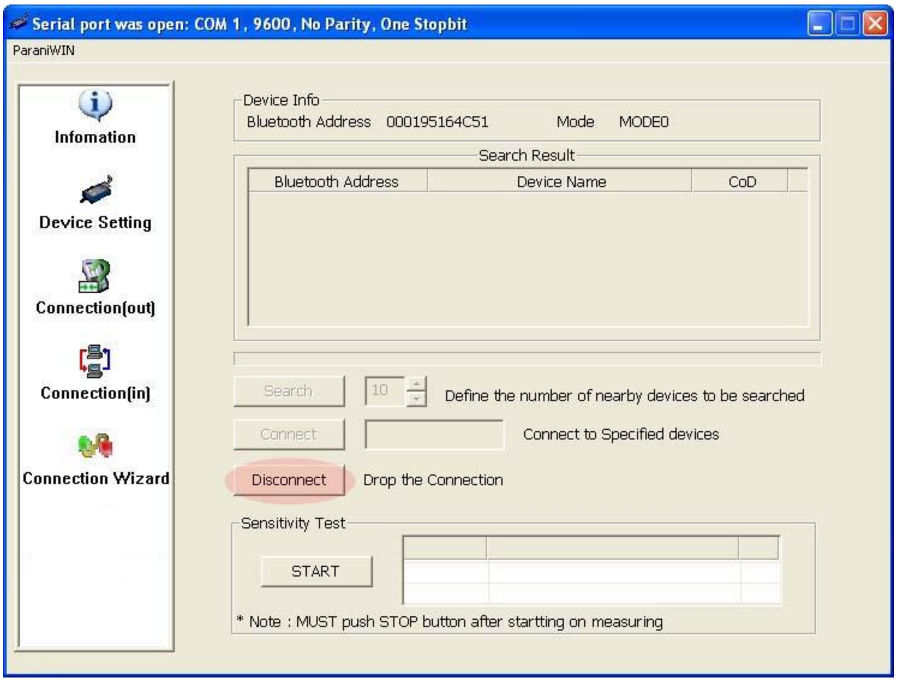


Figure 3-2 Main Window

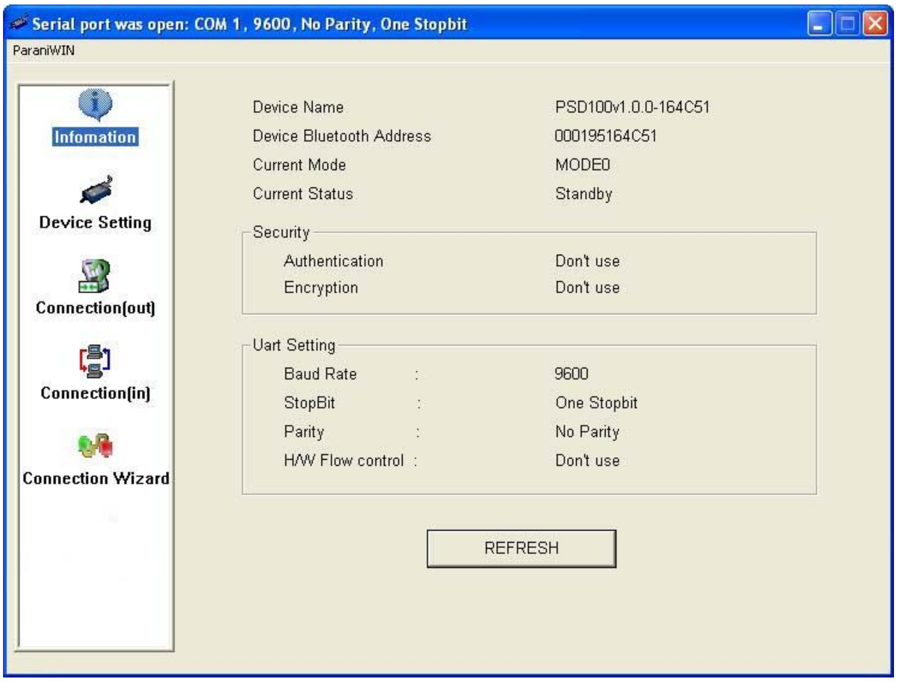


Figure 3-3 Information Window

Serial port settings can be changed by <Start Configuration> and <ParaniWIN Configuration> of

ParaniWIN in the menu bar at upper left corner of the window without re-running the ParaniWIN program.



Figure 3-4 Menu Bar at Upper Left corner of ParaniWIN

When the ParaniWin software is able to access the Parani-BCD110V3 properly, Clicking icons such as Device Setting, Connection(out), Connection(in), Connection Wizard icons opens corresponding window. Clicking the Device Setting icon opens the Device Setting Window where hardware reset can be executed or operation mode and RS232 can be configured as well. The Security option also can be configured in this window.

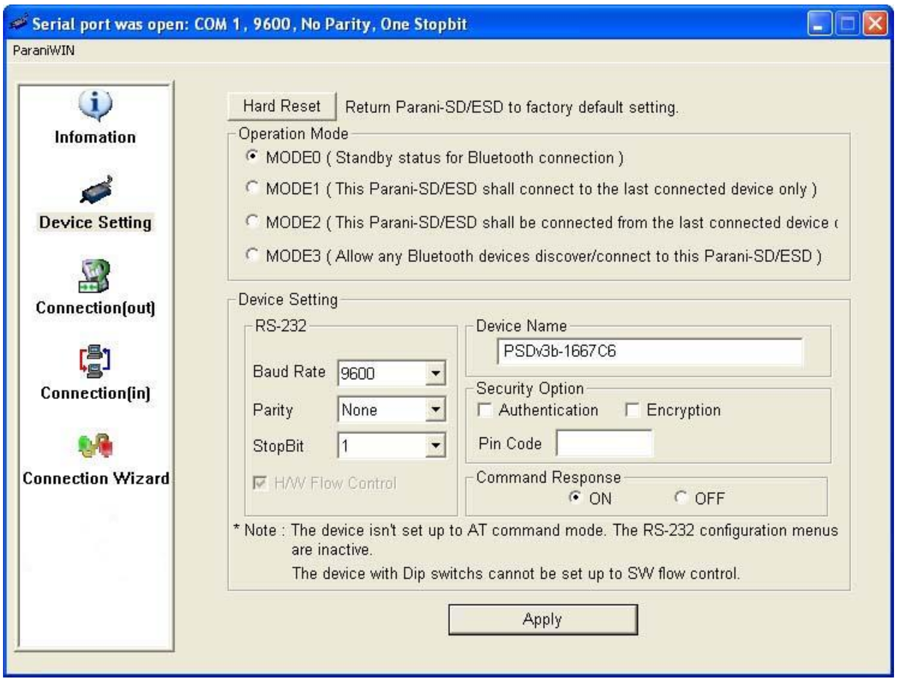


Figure 3-5 Device Setting Window

Parani-BCD110V3 supports two security options, Authentication and Encryption. If you enable the Authentication option, you must also enter a Pin Code value. If the authentication is enabled, the connection, between the Master and Slave device must share the same Pin Code. In case that Parani-BCD110V3 connects to another Bluetooth device, that requires authentication, you must know its Pin Code. In general, most Bluetooth devices have a pin code of 1234 or 0000. The Pin Code of Parani-BCD110V3 is 1234 at default.

If you check Encryption option, the Parani-BCD110V3 will encrypt packets and sent to the device.

If one requests the encryption, the other consents to it. The Encryption options works well in case that only one of the devices between Master and Slave use the Encryption option.

Parani-BCD110V3 has 4 response messages, 'OK', 'ERROR', 'CONNECT', and 'DISCONNECT'. In some cases, these responses can affect the host system unexpectedly. To prevent this, user can set the Command response to ON or OFF.
Click [Apply] button to apply any changes made to Parani-BCD110V3.
Connection (out) icon will show the following window to search and connect other Bluetooth devices.

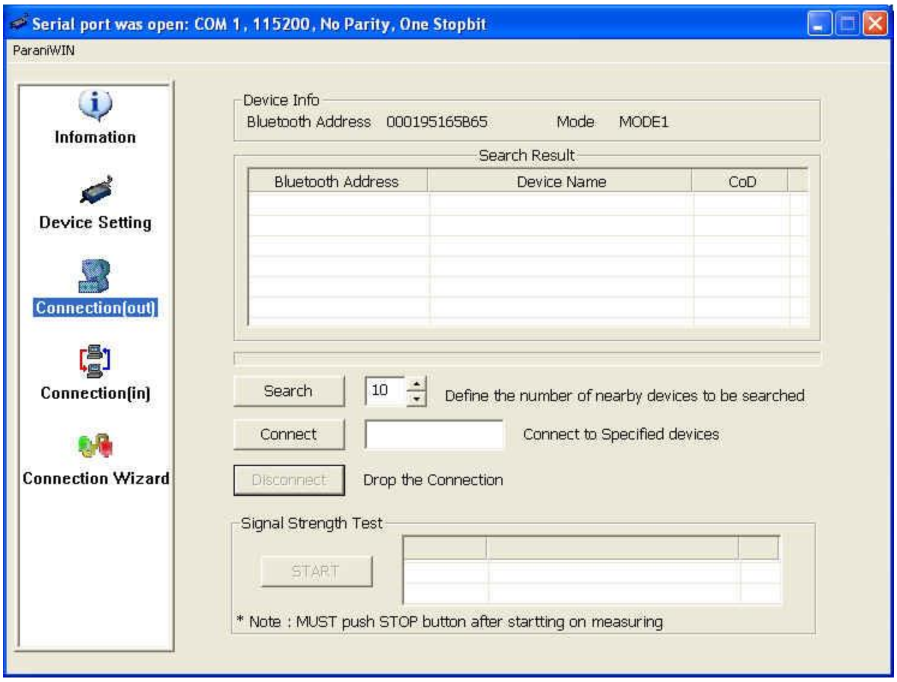


Figure 3-6 Connection (out) Window

Click [Search] button to search nearby Bluetooth devices. Once several Bluetooth devices has been found, select one of the devices and click the [Connect] button. The selected Bluetooth device must be discoverable and connectable. Click [Disconnect] button to cancel the connection.

After the connection has been established, you will be able to test signal strength by pushing the [START] button.

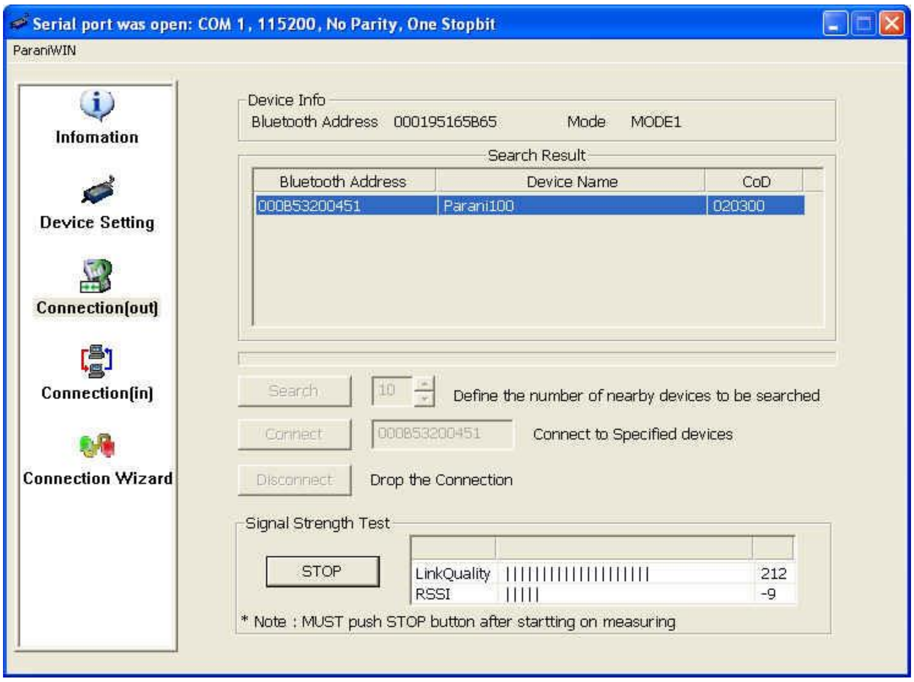


Figure 3-7 Signal Strength Test

The signal strength test shows LInkQuality and RSSI values. The closer LinkQuality is to 255 and RSSI is to 0, the better connection to the connected Bluetooth device has the Parani-BCD110V3. In general, the wireless connectivity is at its best within 10 meters. You can push the STOP button at any time in order to terminate the signal strength test. The signal strength test will continue until the STOP button is pushed. If you close the ParaniWIN Window without pushing the STOP button, you must restart Parani-BCD110V3 to terminate the test.

Connection (in) icon will show the following window, which enables the Parani-BCD110V3 to wait for a connection from another Bluetooth device. If the waiting time is set to 0, Parani-BCD110V3 will continually wait for connection until [Cancel] button is clicked.

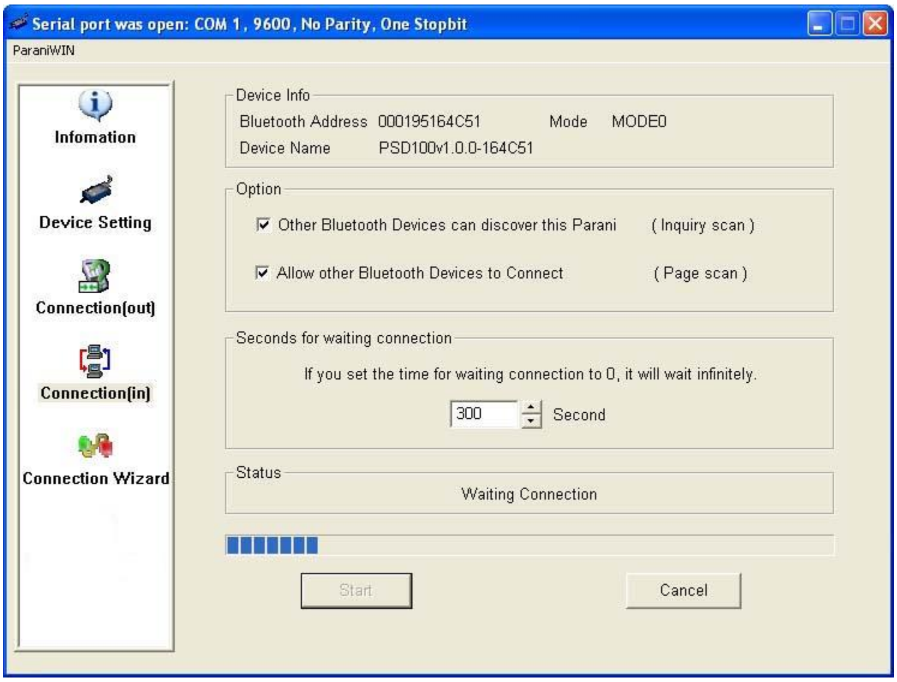


Figure 3-8 Connection (in) Window

If the Connection Wizard icon is clicked, an easy to use pairing menu will appear:

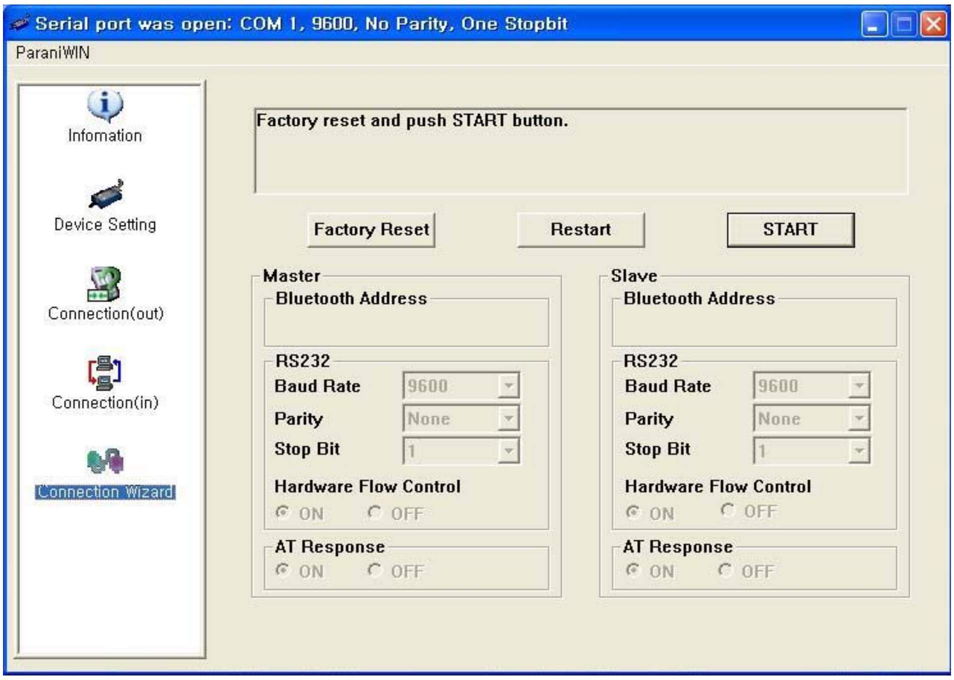


Figure 3-9 Connection Wizard Window

In this example we will refer to the two Parani-BCD110V3s as BCD1 and BCD2 respectively. To

use this menu, please do the following:

Step 1. Connect BCD1 and then push the [START] button after setting up Master configuration.
Step 2. Disconnect BCD1, connect BCD2 and then push the [Next] button after setting up Slave configuration.
Step 3. Disconnect BCD2, once again connect the BCD1 and then push the Finish button. The pairing configuration should be completed. At this point, when both Parani-BCD110V3s are restarted, the connection will be established automatically.

* Note: It is impossible to configure the S-Register and I/O operation. It can be done by AT commands through Terminal program.

3.6.2. ParaniUpdater

Parani-BCD110V3 supports firmware updates. You can download new firmware images for the Parani-BCD110V3 at http://www.sena.com. With the ParaniUpdater, you can update the firmware of Parani-BCD110V3 by selecting the firmware image file and pushing the Start button.

* Note: DO NOT power off Parani-BCD110V3 while the firmware update is progressing. This may damage the Parani-BCD110V3.

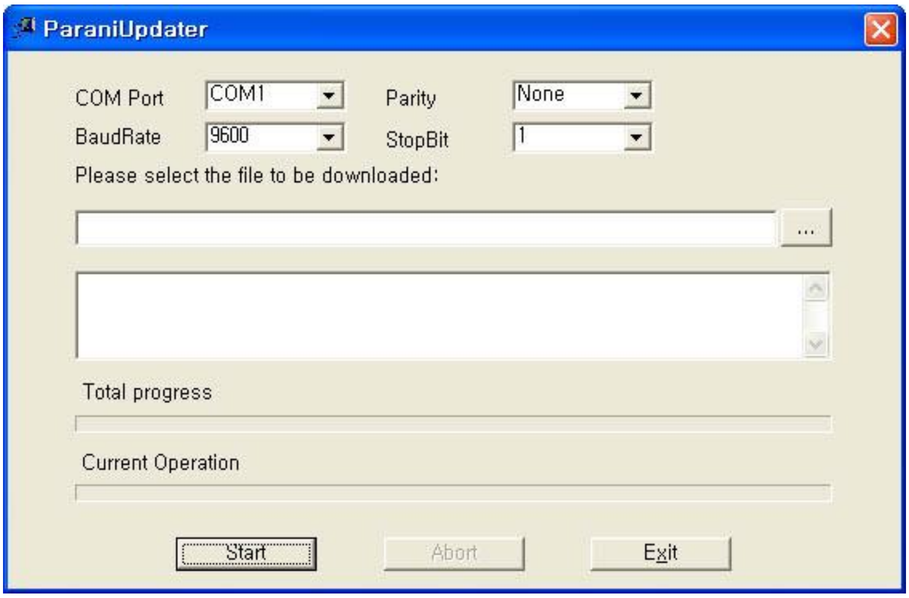


Figure 3-10 ParaniUpdater Window

3.7. Terminal Program

A terminal program is typically an application that will enable a PC to communicate directly with a modem. If you are using Windows 98SE or higher version of Windows, HyperTerminal program is included as part of the operating system. Parani-BCD110V3 provides some extended AT commands for configuration of the Parani-BCD110V3.

This manual will explain the method using HyperTerminal. If you need to install HyperTerminal, click start>setting>control panel>add/remove programs. For more precise details on HyperTerminal installations, please refer to Microsoft Windows Help section.
Attach Parani-BCD110V3 to serial port of host computer and power on the unit.
Launch HyperTerminal. It can be found in start menu >programs >accessories >communication >HyperTerminal. Select the Serial port that Parani-BCD110V3 is connected to.
Input the same settings into Serial port configuration window as Parani-BCD110V3 settings.
Select the Serial port setting displayed in the Window, please make sure the serial settings in HyperTerminal are set to the same settings as the Parani-BCD110V3's serial settings.

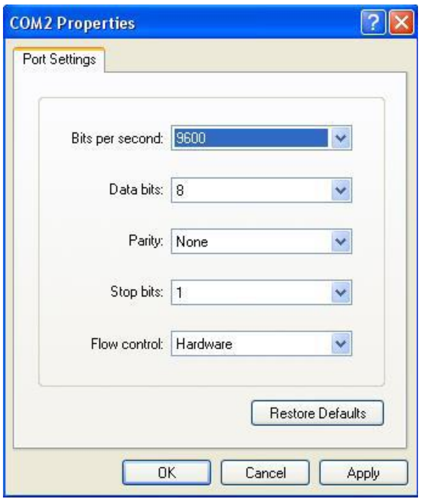


Figure 3-11 HyperTerminal

To view the AT commands that are being typed, you will need to enable the local echo option. Go to File->Properties->Settings->ASCII setup and select the "Echo typed characters locally" option.
For expanded AT commands, please refer to Appendix A. AT commands.

Example of AT commands

```
at

OK
at+btinfo?

000195000144,BCD110v3.0.1-000144,MODE0,STANDBY,0,0,NoFC

OK
at+btinq?

000B5320070E,Promi-MSP_20070E,020300

0009DD500027,LEECOM,1E010C

OK
atd000b5320070e

OK

CONNECT 000B5320070E
```

4. SPP (Serial Port Profile)

4.1. Overview

Parani-BCD110V3 conforms to field-proven standard SPP (Serial Port Profile). This chapter deals with multiple connections out of SPP functions in detail.

Parani-BCD110V3 supports multiple connections up to 7 slave units. There are two types of multiple connection modes: Multi-Drop Mode and Node Switching Mode.

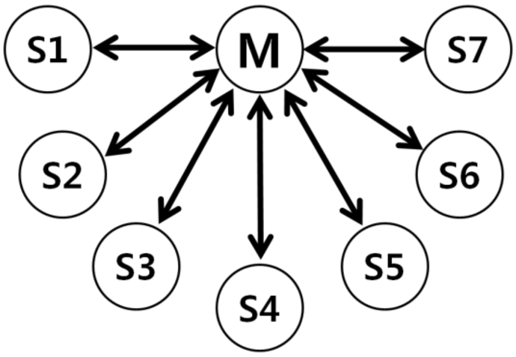


Figure 4-1 Multi-Drop Mode

In Multi-Drop Mode a master unit can connect to maximum 7 slave units at the same time and they transfer data bi-directionally as in Figure 4-1.

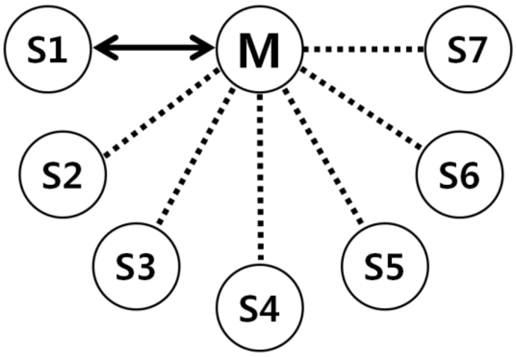


Figure 4-2 Node Switching Mode

In Node Switching Mode, the master unit maintains multiple connections with maximum 7 slave units but only one connection with one slave unit is active and data is transferred as shown in Figure 4-2. After connected to slave, master acts in command mode. Active slave is selected by AT commands.

ATOx<CR>

, which is used to select a node to communicate with and where x is the number of slave.

4.2. Configuration

All the slaves should be in the status of waiting for connection either in Mode 2 or Mode 3 and the master unit tries to connect to the slave units. The master unit needs to be configured to work in a multiple connection mode using AT+MULTI,x command, which makes master reboots after execution.

Table 4-1 AT+MULTI,x

AT+MULTI,0	Single Connection Mode
AT+MULTI,1	Multi-Drop Mode
AT+MULTI,2	Node Switching Mode

Table 4-2 Configuration of a Multiple Connection Mode

Manual Connection	Automatic Connection
ATD000195000001 CONNECT000195000001 +++ OK ATD000195000002 CONNECT000195000002 +++ OK ATD000195000003 CONNECT000195000003 +++ OK ATD000195000004 CONNECT000195000004 +++ ATD000195000005 CONNECT000195000005 +++ ATD000195000006 CONNECT000195000006 +++ ATD000195000007 CONNECT000195000007 +++	ATS46=000195000001 OK ATS54=000195000002 OK ATS55=000195000003 OK ATS56=000195000004 OK ATS57=000195000005 OK ATS58=000195000006 OK ATS59=000195000007 OK AT+MULTI,1 or AT+MULTI,2 OK AT+BTMODE,1 After rebooted automatically master tries to connect to slaves

After input the BD addresses of the slave units into 7 S-registers S46, S54, S55, S56, S57, S58 and S59 and then set operation mode as MODE1, users can use multiple connection function. If S-registers have available slaves' address, AUTO CONNECT message will be displayed following corresponding TASK.

Example of multiple connection mode.

```
TASK1 OK - AUTO CONNECT
TASK2 OK
TASK3 OK - AUTO CONNECT
TASK4 OK
TASK5 OK
TASK6 OK
TASK7 OK
```

4.3. AT Commands

Here are AT commands used in multiple connection mode as below.

4.3.1. AT+MULTI,n

Select a multiple connection mode. Refer to Table 4-1 for descriptions.

4.3.2. AT+MLIST?

It shows the current mode, the connection status and the BD addresses of slaves.

Example of AT+MLIST? Command

```
at+mlist?
CURRENT MODE: MULTI DROP
TASK1 - 000195000001
TASK2 - 000195000002
TASK3 - DISCONNECT
TASK4 - 000195000004
TASK5 - DISCONNECT
TASK6 - DISCONNECT
TASK7 - DISCONNECT
OK
```

4.3.3. ATHx, ATHbdaddr

Using the ATH command, connections with all slaves or only connections with specific slaves can

be disconnected selectively.

Table 4-3 ATH

ATH	Disconnect all the slaves.
ATHx (ATH1, ATH2, ATH3, ATH4, ATH5, ATH6, ATH7)	Disconnect the slave which belongs to the TASK x.
ATHbdaddr (ATH000195000001)	Disconnect the slave with specified BD address.

4.3.4. ATOx, ATObdaddr

Using the ATO command, the communication status with the last active slave or a specific slave can be set to online (only in Node Switching Mode).

Table 4-4 ATO

ATO	Communicate with the slave recently communicated.
ATOx (ATO1, ATO2, ATO3, ATO4, ATO5, ATO6, ATO7)	Communicate with the slave which belongs to the TASK x.
ATObdaddr (ATO000195000001)	Communicate with the slave with specified BD address.

Example of ATO command

```
On communication after connecting

ATO1 - Communicating with #1 Slave

+++

OK

ATO000195000003 - Communicating with slave of BD 000195000003
```

4.4. Notes

When large data exchange occurs in Multi-Drop mode without flow-control enabled, the master unit may experience data loss. It may also experience occasional disconnections and/or system rebooting especially when bi-directional communication happens. It is strongly recommended to perform extensive performance test before any real world field applications.
The master unit would try to connect all slave units specified by S-register 46, 54, 55, 56, 57, 58 and 59. If non-existing or inactive slave addresses are entered in these S-registers, the overall performance will degrade due to frequent connection trials to non-existing/inactive slaves. It may also force disconnections for overall performance and output disconnect messages repeatedly.
Node-switching mode provides nearly equivalent performance as single connection mode. It is always recommended to use flow-control for both of Multi-Drop Mode and Node Switching Mode.

5. Sena I/O Profile

5.1. Overview

Parani-BCD110V3 provides the method to use the inputs and outputs pins embedded in the module. It has total 12 I/O pins which consist of 2 AIO pins and 10 DIO pins. Out of 10 DIO pins, only 5 pins except the pins assigned to DCD, DTR, DSR, FACTORY_RESET and MODE can be used for DIO. The AIO pins can be used for input only and the DIO pins can be used for input and output according to the I/O configuration.
The I/O pins can be utilized through Bluetooth connection in two ways: remote sampling and synchronization. The synchronization through I/O Profile connection is available only in single connection mode.
This chapter describes the usage of the I/O in Parani-BCD110V3, separated by sampling and synchronization.

Table 5-1 I/O Table

Pin Number	I/O Number	Special Functions	AI Enable
4	0	AIO_0	O
5	1	AIO_1	O
29	2	PIO_2 / UART_DCD	X
28	3	PIO_3 / UART_DTR	X
24	4	PIO_4 / UART_DSR	X
25	5	PIO_5 / FACTORY_RESET	X
26	6	PIO_6 / MODE	X
27	7	PIO_7 / DIO_0	X
30	8	PIO_8 / DIO_1	X
31	9	PIO_9 / DIO_2	X
32	10	PIO_10 / DIO_3	X
33	11	PIO_11 / DIO_4	X

Sampling means reading the status of the I/O pins in remote Parani-BCD110V3. It is implemented in the Remote Configuration mode which is based on SPP connection as shown Figure 5-1.

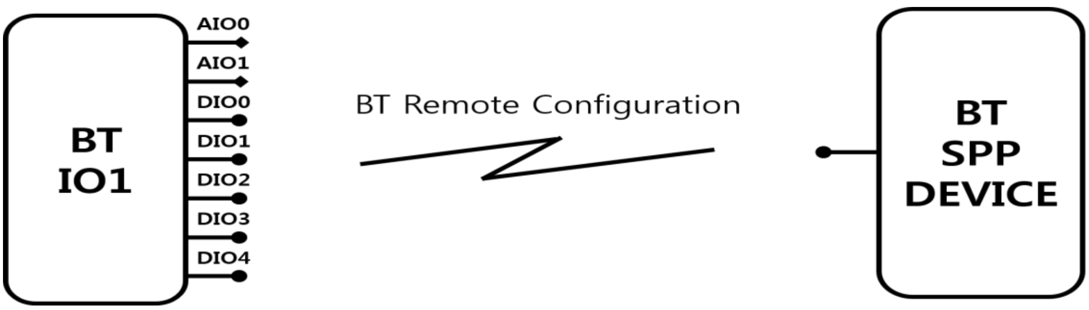


Figure 5-1 I/O Sampling

As shown Figure 5-2, synchronization means that the I/O status of two Parani-BCD110V3s on I/O profile connection are synchronized with those of each other. It is committed in various ways according to the configuration of synchronization for each pin.

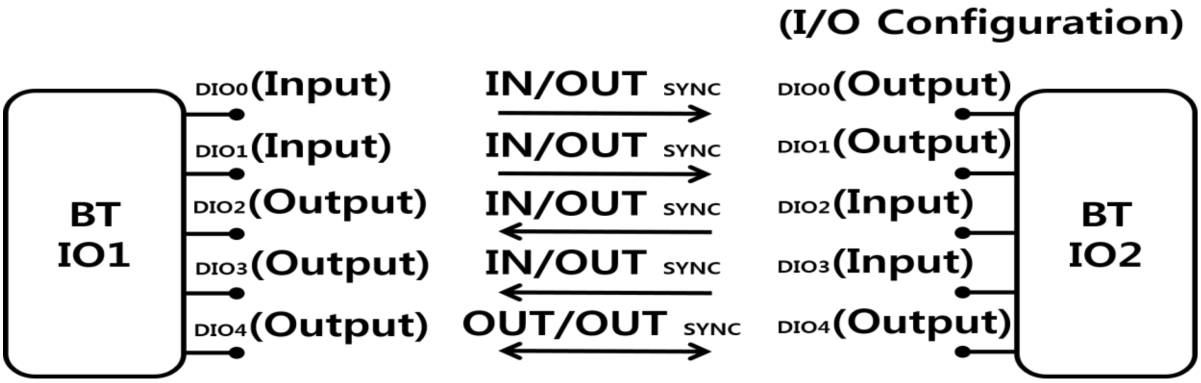


Figure 5-2 DIO Synchronization

5.2. I/O Configuration

To use the inputs and outputs pins embedded in the module, their functions are set in advanced. The AT command below can be used to change I/O configuration. Changes of I/O configuration are applied after rebooting.

AT+SETIO=<value1><value2><value3><value4><value5><value6><value7><CR>

, where value1 ~ value2 are for AIO configuration and their value can be 0 or 1 and value3 ~ value7 are for DIO and their value can be 0 ~ 4.
The meaning of the values of AIO and DIO are as below and "AT+IOINFO" displays the current I/O settings.

AIO Configuration
0 Disable
1 Enable

DIO Configuration
0 Disable
1 Digital Input: default PULLDOWN
2 Digital Input: default PULLUP
3 Digital Output: default LOW
4 Digital Output: default HIGH

Table 5-2 Example of I/O Configuration

AT+SETIO=	0	1	0	1	2	3	4
	AIO0	AIO1	DIO0	DIO1	DIO2	DIO3	DIO4
	Disable	Enable	Disable	Input: down	Input: up	Output: low	Output: high

5.3. I/O Sampling

The I/O status can be monitored and controlled using the AT commands. The I/O status of remote device can be monitored and controlled using Remote Configuration on SPP connection, too. Please refer to the 3.5 Remote configuration Mode for more details regarding Remote Configuration.

5.3.1. Queried Sampling

The digital and analog I/O status of Parani-BCD110V3 can be monitored and controlled using the AT commands either locally or remotely.

AT+DIO?<CR>

The AT+DIO command can be used to read the digital I/O line values. Return value is a combination of 0 (Low) and 1 (High).
It can also be used to set the digital output lines.

AT+DIO=<value1><value2><value3><value4><value5><CR>

, where value1 ~ value5 can be 0(Low) or 1(High) in each.

AT+AIO?<CR>

The analog input values can be read using the AT+AIO command. The unit of return value is Voltage and the range is between 0 and 1.5V approximately.
Users can monitor and control the status of remote Parani-BCD110V3 on SPP connection using Remote Configuration as below:

Example of Queried Sampling

```
CONNECT 000B5320070E
---

?Please Enter Password
at+pass=0000

OK

Remote Configuration Enabled
at+dio?

DIO:<00000>

OK
At+dio=10101

OK
At+dio?

DIO:<10101>

OK
at+aio?

AIO0 : <0.8732>

OK
```

5.3.2. Periodic Sampling

The digital and analog I/O status of Parani-BCD110V3 can be monitored periodically.

AT+IOPS=<value><CR>

, where value is the I/O sampling period between 0 and 3600 in second. If set to 0, Periodic sampling is disabled.
The I/O status of remote Parani-BCD110V3 on SPP connection can be monitored in the remote Periodic Sampling like the remote Queried Sampling by using the Remote Configuration.

Example of Periodic Sampling

```
at+iops=10
OK
AIO0 : <0.8732>, AIO1 : <1.4721>, DIO:<01000>
AIO0 : <0.7673>, AIO1 : <1.4801>, DIO:<00000>
AIO0 : <0.5725>, AIO1 : <1.4773>, DIO:<00100>
AIO0 : <0.4725>, AIO1 : <1.4735>, DIO:<00100>
```

5.3.3. Change Detection Sampling

The digital I/O status of Parani-BCD110V3 can be monitored whenever a monitored digital I/O pin changes state.

AT+DIOCDS=<value><CR>

Set DIO change detection sampling mode. If set to 0, DIO change detection sampling is disabled.
The DIO change detection sampling and the Periodic Sampling can be set and used at the same time.
The DIO status of remote Parani-BCD110V3 on SPP connection can be monitored in the remote DIO Change Detection Sampling like the remote Queried Sampling by using the Remote Configuration.

Example of DIO Change Detection Sampling

```
at+diocds=1
OK
AIO0 : <0.8732>, AIO1 : <1.4721>, DIO:<01000>
AIO0 : <0.8725>, AIO1 : <1.4705>, DIO:<00000>
AIO0 : <0.8752>, AIO1 : <1.4736>, DIO:<10000>
AIO0 : <0.8739>, AIO1 : <1.4760>, DIO:<10000>
```

5.3.4. AIO Change Detection Sampling

The AIO change detection sampling is difficult because the value of AIO varies continuously. For this reason, the AIO values are not sampled whenever AIO value changes. Instead, sampling is committed when AIO value is out of range specified at the Falling edge and Rising edge. That is, the analog I/O values of Parani-BCD110V3 can be monitored when AIO value falls down below the Falling edge or rises up above the Rising edge immediately.

AT+AIOCDS = <value, AIO0 Rising edge, AIO0 Falling edge, AIO1 Rising edge, AIO1 Falling edge><CR>

The AT+AIOCDS command can be used to set AIO change detection sampling mode. The value ranges from 0 to 10. The less value is, the more often the AIO values are sampled. If it is set to 0, the AIO change detection sampling is disabled.
The AIO value of remote Parani-BCD110V3 on SPP connection can be monitored in the remote AIO Change Detection Sampling like the remote Queried Sampling by using the Remote Configuration.

* If the Rising edge is greater than the Falling edge, the AIO value will be monitored when AIO value is between the Falling edge and the Rising edge.

Example of AIO Change Detection Sampling

```
at+aiocds=1,15000,0,15000,0

OK

AIO0 : <1.5096>, AIO1 : <1.4721>, DIO:<00000>

AIO0 : <1.5032>, AIO1 : <1.4721>, DIO:<00000>
```

5.4. DIO Synchronization

The Parani-BCD110V3 supports that the both sides of I/O profile connection synchronize their DIO status. The DIO Synchronization means that one device on I/O profile connection adjusts its DIO status according to the DIO status of the other device or vice versa. It is available only when both devices are connected on the I/O profile.
The I/O profile connection is possible when both devices are in single connection mode and have at least one DIO pin which is set to digital I/O.

AT+IOCONNECT<bdaddr><CR>

The AT+IOCONNECT command can be used to connect on the I/O profile to the device which is designated at <bdaddr>.
Both Parani-BCD110V3s of the I/O profile connection are synchronized in two ways – Input/Output synchronization and Output/Output synchronization – according to the I/O configuration and DIO synchronization configuration. The I/O configuration is specified by the AT+SETIO=<values>" command and the DIO synchronization by the "AT+IOSYNC=<value>"

command.

AT+ IOSYNC =<value1><value2><value3><value4><value5><CR>

, where <value1>~<value5> can have a value between 0 and 3 as below:

DIO Synchronization Configuration
0 Disabled
1 Synchronization Input
2 Synchronization Output
3 Synchronization Input/Synchronization Output

The output status of a DIO output pin with Synchronization Output at one device changes according to the DIO input status of corresponding DIO input pin with Synchronization Input at the other device. A DIO output pin with Synchronization Input/Synchronization Output can be used as Synchronization Input or Synchronization Output.
"1 Synchronization Input" and "2 Synchronization Output" is explained at 5.4.1 Input/Output Synchronization in detail. "3 Synchronization Input/Synchronization Output" is described at 5.4.2 Output/Output Synchronization in detail.

Table 5-3 DIO Example of DIO Synchronization Configuration

AT+IOSYNC=	0	1	2	3	0
	DIO0	DIO1	DIO2	DIO3	DIO4
	Disabled	Synchronization Input	Synchronization Output	Synchronization Input /Synchronization Output	Disabled

* Changes of DIO Synchronization configuration are applied without rebooting.

5.4.1. Input/Output Synchronization

The Input/Output Synchronization means the synchronization between two Parani-BCD110V3s which are connected on I/O profile – one is set as Digital Input for I/O configuration and the other is set as Digital Output.
For example, let's assume that there are two Parani-BCD110V3s connected on I/O profile which are BCD1 and BCD2. The DIO1 of BCD1 is set as Digital Input for I/O configuration and Synchronization Input for DIO Synchronization Configuration. The DIO1 of BCD2 is set as Digital Output for I/O Configuration and Synchronization Output for DIO Synchronization Configuration. When DIO1 status of BCD1 changes, DIO1 status of BCD2 is synchronized as to DIO1 status of BCD1.

5.4.2. Output/Output Synchronization

The Output/Output Synchronization means the synchronization between two Parani-BCD110V3s which are connected on I/O profile and whose I/O configuration are Digital Output.
For example, let's assume that there are two Parani-BCD110V3s connected on I/O profile which are BCD1 and BCD2. The DIO1 of BCD1 is set as Digital Output for I/O Configuration and

Synchronization Input/Synchronization Output for DIO Synchronization Configuration. The DIO1 of BCD2 is also set as Digital Output for I/O Configuration and Synchronization Input/Synchronization Output for DIO Synchronization Configuration. When DIO1 status of BCD1 changes, DIO1 status of BCD2 is synchronized as to DIO1 status of BCD1. In same way, DIO1 status of BCD1 is synchronized with DIO1 status of BCD2, too. In case of Output/Output Synchronization, of two Parani-BCD110V3s connected on I/O profile, when one device changes in DIO status by AT command, the other device is automatically synchronized.

* Each 5 DIO pin separately works. That means, each DIO pin can be set as Input/Output Synchronization or Output/Output Synchronization.

Table 5-4 and Figure 5-3 below describes how both Parani-BCD110V3s of the I/O profile connection works according to I/O Configuration and DIO Synchronization Configuration.

Table 5-4 Way to synchronize DIO

BCD 1		Way to Synchronize	BCD 2	
I/O Configuration	DIO Synchronization Configuration		I/O Configuration	DIO Synchronization Configuration
Digital Input	Synchronization Input	Input/Output synchronization (BCD 1->BCD 2)	Digital Output	Synchronization output
Digital Output	Synchronization Output	Input/Output synchronization (BCD 1<-BCD 2)	Digital Input	Synchronization Input
Digital Output	Synchronization Input/ Synchronization Output	Output/Output synchronization (BCD 1<->BCD2)	Digital Output	Synchronization Input/ Synchronization Output

Example of DIO Synchronization

```
BCD 1

at+setio=0011334

OK
at+iosync=11223

OK
atz

OK
at+ioconnect0001951330fe

OK

IOPROFILECONNECT 0001951330FE
```

```
BCD 2

at+setio=0033114

OK
atz

OK
at+iosync=22113

OK
at+btscan

OK

IOPROFILECONNECT 0001951330FD
```

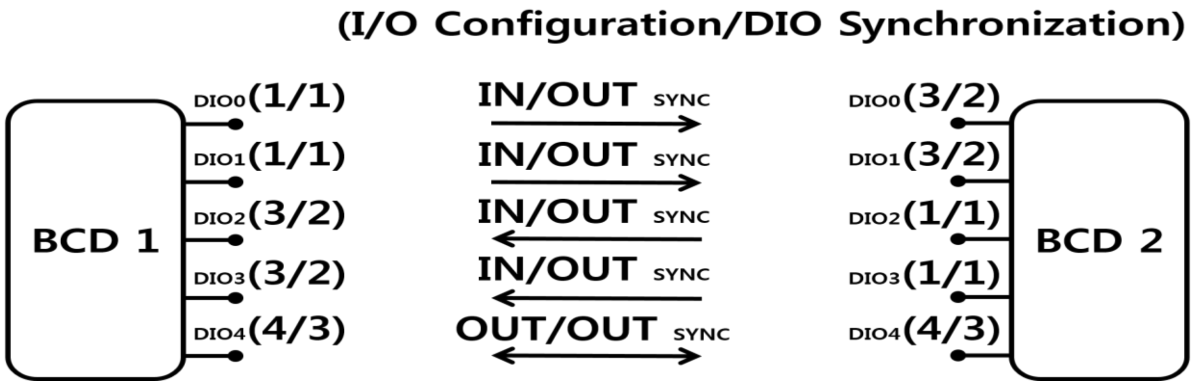


Figure 5-2 DIO Synchronization According to I/O Configuration and DIO Synchronization Configuration

6. SCO (Synchronous Connection Oriented)

6.1. Overview

There are two Bluetooth link types according to the sensitivity to delay time: One is SCO (Synchronous Connection Oriented) link for voice or audio which is sensitive to delay time. The other is ACL (Asynchronous ConnectionLess) link for packet data communication which is less sensitive to delay time. Because SCO link can be established only after ACL link is established, ACL link is also important to voice system.
This chapter describes the characteristics and usage of SCO link to use PCM input provided by Parani-BCD110V3.

6.2. Characteristics

Parani-BCD110V3 supports single voice link at 8Khz. This voice link enables voice communication to the degree of cellular phone, but is not suitable for music.

6.3. SCO Connection

SCO connection is available only when two devices are connected in single connection mode on SPP and the property of 'Enable SCO' is enabled.

ATS84 = <Value><CR>

Enable SCO. If <value> is 0, SCO is disabled.

AT+SCOCONNECT<CR>

In case that SPP connection is established between two devices with 'Enable SCO' enabled, AT+SCOCONNECT command establishes SCO connection and make Bluetooth voice communication possible at the Development Board or PCM interface made like Appendix F.

AT+SCODISCONNECT<CR>

AT+SCODISCONNECT command closes SCO connection. Though SCO connection is closed, SPP connection is still maintained. On the contrary, when SPP connection is closed, SCO connection is also released.

Example of SCO Connection

```
atd0001951330f9

OK

CONNECT 0001951330F9
+++
OK
at+scoconnect

OK

SCOCONNECT 0001951330F9
```

7. Approval Information

7.1. FCC

FCC Rule: Part 15 Subpart C Section 15.247
FCCID: S7AIW02

7.1.1. FCC Compliance Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and
(2) This device must accept any interference received,

Including interference that may cause undesired operation

Information to User

This equipment has been tested and found to comply with limits for a Class B digital device, Pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

This equipment generate, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications.

However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver-Connect the equipment into an outlet a circuit different form that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

7.1.2. RF Exposure Statement

The equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This device and its antenna must not be co-located or operation in conjunction with any other antenna or transmitter.

7.1.3. Do not

Any changes or modifications to the equipment not expressly approved by the party responsible for compliance could void user's authority to operate the equipment.

7.2. CE

CE1177ⓘ

Declare under our own responsibility that the product
Bluetooth Module
Brand name: SENA
Model No.: Parani-BCD110DU / Parani-BCD110DC / Parani-BCD110DS
Parani-BCD110SU / Parani-BCD110SC
To which this declaration refers conforms with the relevant standards or other standardizing documents
EN 60950-1
ETSI EN 301 489-1
ETSI EN 301 489-17
ETSI EN 300 328
According to the regulations in Directive 1999/5/EC

7.3. IC

Radio Cert. No.: IC: 8154A-IW02

7.4. KCC

Type Registration
Certification No: KCC-CRM-SNA-IW02

7.5. TELEC

Technical Regulations for Specified Radio Equipment Article 2, Section 1 (19)
Certification No:
Parani-BCD110DU : 010WWBT0128
Parani-BCD110DC : 010WWBT0129
Parani-BCD110DS : 010WWBT0130

7.6. SIG

QDID: B016862
Model Name: Parani-BCD110
Core Version: 2.0+EDR
Product Type: End Product
Declared Specifications: Baseband Conformance, Radio, Service Discovery Protocol, Logical Link Control and Adaption Protocol, Generic Access Profile, Link Manager, RFCOMM, Serial Port Profile, Host Controller Interface, Summary ICS, Product Type

8. RF Information

8.1. Radio Frequency Range

2.402~2.480GHz

8.2. Number of Frequency Channel

79 channels

8.3. Transmission Method

FHSS(Frequency Hopping Spread Spectrum)

8.4. Modulation Method

1Mbps: GFSK(Gaussian Frequency Shift Keying)
2Mbps: π/4 DQPSK(pi/4 rotated Differential Quaternary Phase Shift Keying)
3Mbps: 8DPSK(8 phase Differential Phase Shift Keying)

8.5. Radio Output Power

Products	Radio Output Power
Parani-BCD110	+18dBm

8.6. Receiving Sensitivity

Products	Receiving Sensitivity
Parani-BCD110	-90dBm

8.7. Power Supply

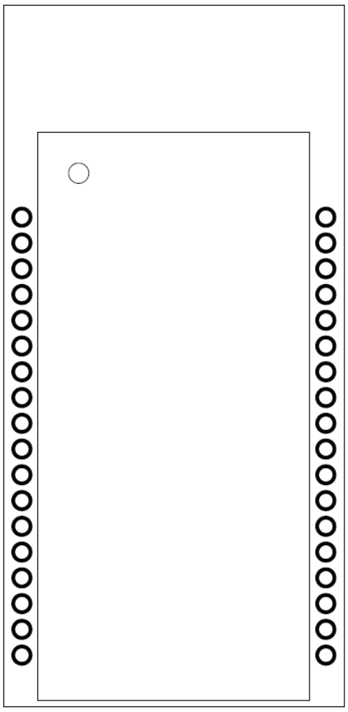
Products	Power Supply
Parani-BCD110	DC3.3V

Appendix A: Connections

A.1. Pin Assignment

A.1.1. Parani-BCD110V3

No	NAME	DEFINE
1	GND	GND
2	GND	GND
3	PVCC	PVCC (+3.3V)
4	AIO_0	AIO_0
5	AIO_1	AIO_1
6	UART_RTS	UART_RTS
7	UART_RXD	UART_RXD
8	UART_TXD	UART_TXD
9	UART_CTS	UART_CTS
10	USB_DN	N/A
11	USB_DP	N/A
12	PCM_IN	PCM_IN
13	PCM_SYNC	PCM_SYNC
14	PCM_CLK	PCM_CLK
15	PCM_OUT	PCM_OUT
16	+3V3	+3V3
17	GND	GND
18	RESETB	RESETB



DEFINE	NAME	No
GND	GND	36
GND	GND	35
GND	GND	34
DIO_4	PIO_11	33
DIO_3	PIO_10	32
DIO_2	PIO_9	31
DIO_1	PIO_8	30
UART_DCD	PIO_2	29
UART_DTR	PIO_3	28
DIO_0	PIO_7	27
BT_MODE	PIO_6	26
FACTORY RESET	PIO_5	25
UART_DSR	PIO_4	24
N/A	SPI_MOSI	23
N/A	SPI_CSB	22
N/A	SPI_CLK	21
N/A	SPI_MISO	20
GND	GND	19

Table A-1 Pin Assignment of Parani-BCD110V3

Pin	Pin Name	Direction IN/OUT	Pin State	Description
1	GND	-	-	Ground
2	GND	-	-	Ground
3	PVCC	-	-	Power supply for power amplifier, 3.3V
4	AIO_0	IN	-	Analogue input
5	AIO_1	IN	-	Analogue input
6	UART_RTS	OUT	Pull-up	UART request to send active low
7	UART_RXD	IN	Pull-down	UART data input
8	UART_TXD	OUT	Pull-up	UART data output
9	UART_CTS	IN	Pull-down	UART clear to send active low
10	N/A	-	-	-
11	N/A	-	-	-
12	PCM_IN	IN	Pull-down	Synchronous data input
13	PCM_SYNC	IN	Pull-down	Synchronous data sync
14	PCM_CLK	IN	Pull-down	Synchronous data clock
15	PCM_OUT	OUT	Pull-down	Synchronous data output
16	+3V3	-	-	Power supply for system, 3.3V
17	GND	-	-	Ground
18	RESETB	IN	Pull-up	Reset, active low, > 5ms to cause a reset
19	GND	-	-	Ground
20	N/A	-	-	-
21	N/A	-	-	-
22	N/A	-	-	-
23	N/A	-	-	-
24	UART_DSR	IN	Pull-up	UART data set ready
25	FACTORY_RESET	IN	Pull-up	Input for factory default setting, (Active 'L')
26	BT_MODE	IN	Pull-up	Input for pairing mode
27	DIO_0	IN/OUT	-	Digital input/output
28	UART_DTR	OUT	Pull-down	UART data terminal ready
29	UART_DCD	OUT	Pull-down	UART data carrier detect
30	DIO_1	IN/OUT	-	Digital input/output
31	DIO_2	IN/OUT	-	Digital input/output
32	DIO_3	IN/OUT	-	Digital input/output
33	DIO_4	IN/OUT	-	Digital input/output
34	GND	-	-	Ground
35	GND	-	-	Ground
36	GND	-	-	Ground

A.1.2. Bluetooth Connection Detect (UART_DCD) Signal

Status of Bluetooth connection will be delivered to Host PC via UART_DCD signal. When Bluetooth connection is made, UART_DCD signal will be set to low.

A.1.3. Factory Reset (FACTORY_RESET) Signal

Parani-BCD110V3 provides a pairing signal input for instant configuration and automatic connection to two Parani-BCD110V3s. In this example, we will name the two Parani-BCD110V3s as BCD1 and BCD2 In pairing mode.

A.1.4. Pairing (BT_MODE) Signal

Parani-BCD110V3 provides a pairing signal input for instant configuration and automatic connection to two Parani-BCD110V3s. In this example, we will name the two Parani-BCD110V3s as BCD1 and BCD2 In pairing mode.

Step 1. Turn on BCD1 and BCD2 and do factory default both of them by using RST signal.
Step 2. Set the pairing signal of BCD1 to low state and hold the signal for 2 seconds.
Step 3. Set the pairing signal of BCD2 to low state and hold the signal for 2 seconds.
Set the pairing signal of BCD2 to high state and hold the signal for 2 seconds. Now Set the pairing signal of BCD2 to low state and hold it for 2 seconds.
Step 4. Wait for BCD1 & BCD2 to connect to each other. It may take about 10 seconds to make a connection. If there are many Bluetooth devices nearby, the connection time may increase.
Step 5. At this point your pair of Parani-BCD110V3 is configured to make automatic connection to each other.

You can now use this pair of Parani-BCD110V3s like virtual serial cable.

* Note: During the pairing process, by way of the pairing signal, the Command Response will be deactivated. Thus, the Parani-BCD110V3 will not send the response messages such as OK, Connect and Disconnect.

Table A-2 Pairing Process by Pairing Signal

BCD1	Status	BCD2	Status
1. Reset	Mode0	1. Reset	Mode0
2. Drop pairing signal	Mode3	2. Drop pairing signal	Mode3
3. Restore pairing signal	Mode3	3. Restore pairing signal	Mode3
		4. Drop pairing signal	Mode1
		5. Restore pairing signal	Mode1
6. Connected	Slave	6. Connected	Master

Using pairing signal, users can make a pairing connection between a Parani-Parani-BCD110V3 unit and other Bluetooth devices.

Step 1. Turn on BCD1 and do factory default by using RST signal.
Step 2. Set the pairing signal of BCD1 to low state and hold the signal for 2 seconds.
Step 3. Users can discover and connect to BCD1 by using the software or user interface of other Bluetooth device that they want to connect from.
Step 4. Wait for BCD1 & other Bluetooth device to connect to each other. It may take about 10 seconds to make a connection. If there are many Bluetooth devices nearby, the connection time may increase.
Step 5. Now BCD1 is waiting for a connection from the last connected Bluetooth device. The last connected Bluetooth device can connect to BCD1.

Table A-3 Pairing Process with other Bluetooth device by Pairing Signal

BCD1	Status	Other Bluetooth Device	Status

1. Reset	Mode0		
2. Drop pairing signal	Mode3		
		3. Inquiry and connect to BCD1	
4. Connected	Slave	4. Connected	Master

Using pairing signal, users can make pairing connections between a Parani-Parani-BCD110V3 unit and multiple Bluetooth devices in Multi-Drop Mode. Up to 7 connections can be established. In this example, we will name a Parani-BCD110V3 master as Master and 7 Parani-BCD110V3s as Slave1, Slave2, Slave3, Slave4, Slave5, Slave6, Slave7.

Step 1. Turn on Master, Slave1, Slave2, Slave3, Slave4, Slave5, Slave6, Slave7 and do factory default by using RST signal.
Step 2. Set the pairing signal of Slave1, Slave2, Slave3, Slave4, Slave5, Slave6, Slave7 to low state and hold the signal for 2 seconds to make them in Mode3.
Step 3. Turn them off.
Step 4. Set the pairing signal of Master to low state and hold the signal for 2 seconds.
Step 5. . Turn Slave1 on.
Step 6. Set the pairing signal of Master to low state and hold the signal for 2 seconds. Master discovers and connect to Slave1, then Master is in Mode1 and Slave1 in Mode2. The BD address of Slave1 is stored at S46 of Master.
Step 7. Turn Slave2 on.
Step 8. Set the pairing signal of Master to low state and hold the signal for 2 seconds. Master discovers and connect to Slave2, then Master is in Mode1 / Multi-Drop Mode and Slave2 in Mode2. The BD address of Slave2 is stored at S54 of Master.
Step 9. Turn Slave3 on.
Step 10. Set the pairing signal of Master to low state and hold the signal for 2 seconds. Master discovers and connect to Slave3, then Master is in Mode1 / Multi-Drop Mode and Slave3 in Mode2. The BD address of Slave3 is stored at S55 of Master.
Step 11. Turn Slave4 on.
Step 12. Set the pairing signal of Master to low state and hold the signal for 2 seconds. Master discovers and connect to Slave4, then Master is in Mode1 / Multi-Drop Mode and Slave4 in Mode2. The BD address of Slave4 is stored at S56 of Master.
Step 13. Turn Slave5 on.
Step 14. Set the pairing signal of Master to low state and hold the signal for 2 seconds. Master discovers and connect to Slave5, then Master is in Mode1 / Multi-Drop Mode and Slave5 in Mode2. The BD address of Slave5 is stored at S57 of Master.
Step 15. Turn Slave6 on.
Step 16. Set the pairing signal of Master to low state and hold the signal for 2 seconds. Master discovers and connect to Slave6, then Master is in Mode1 / Multi-Drop Mode and Slave6 in Mode2. The BD address of Slave6 is stored at S58 of Master.
Step 17. Turn Slave7 on.
Step 18. Set the pairing signal of Master to low state and hold the signal for 2 seconds. Master discovers and connect to Slave7, then Master is in Mode1 / Multi-Drop Mode and Slave7 in Mode2. The BD address of Slave6 is stored at S59 of Master. Once master connects to 7 slaves, setting the pairing signal of master to low state is ignored and does not do anything.
Step 19. When any slave turns off and on, Master in Multi-Drop Mode automatically reconnects to it.

Table A-4 Pairing Process with multiple Bluetooth devices by Pairing Signal

Master	Status	Slave	Status
1. Factory Reset	Mode0		
		2. Slave 1,2,3,4,5,6,7 Factory reset	Mode0
		3. Slave 1,2,3,4,5,6,7Drop pairing signal	Mode3
4. Drop pairing signal	Mode3		
5. Drop pairing signal	Mode1		
6. Slave1 connected	Mode1	6. Slave 1 connected	Mode2
7. Drop pairing signal	Mode1		
8. Changed Multi-Drop Mode	Mode1	6. Slave 1 disconnected	Mode2
9. Slave 1 connected	Mode1	9. Slave 1 connected	Mode2
10. Changed Multi-Drop Mode	Mode1		
11. Slave 2 connected	Mode1	11. Slave 2 connected	Mode2
12. Changed Multi-Drop Mode	Mode1		
13. Slave 3 connected	Mode1	13. Slave 3 connected	Mode2
14. Changed Multi-Drop Mode	Mode1		
15. Slave 4 connected	Mode1	15. Slave 4 connected	Mode2
16. Changed Multi-Drop Mode	Mode1		
17. Slave 5 connected	Mode1	17. Slave 5 connected	Mode2
18. Changed Multi-Drop Mode	Mode1		
19. Slave 6 connected	Mode1	19. Slave 6 connected	Mode2
20. Changed Multi-Drop Mode	Mode1		
21. Slave 7 connected	Mode1	20. Slave 7 connected	Mode2

A.1.5. Reset (RESETB) Signal

Parani-BCD110V3 can be reset from one of following sources:

- RESETB pin
- Power on reset

The RESETB pin is an active low signal and is internally filtered using the internal low frequency clock oscillator. A reset will be performed between 1.5 and 4.0ms following RESETB being active. So it is recommended that RESETB be applied for a period greater than 5ms.

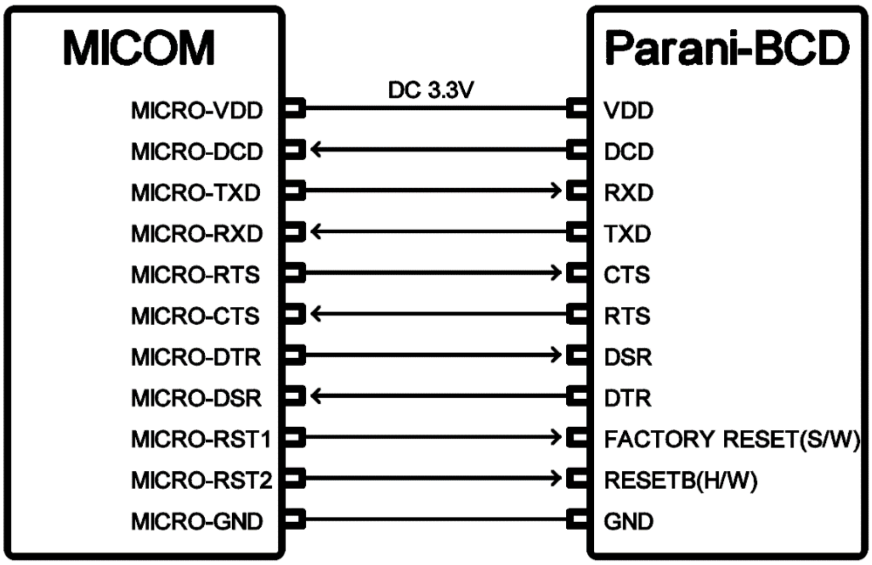
A.1.6. PVCC Input

If PVCC input is not wired or input power is lower than 3.3V, working distance may be less than that of the product specification which is 200m(0.12 mile) by defalut antenna and 1000m(0.62 mile) at maximum.

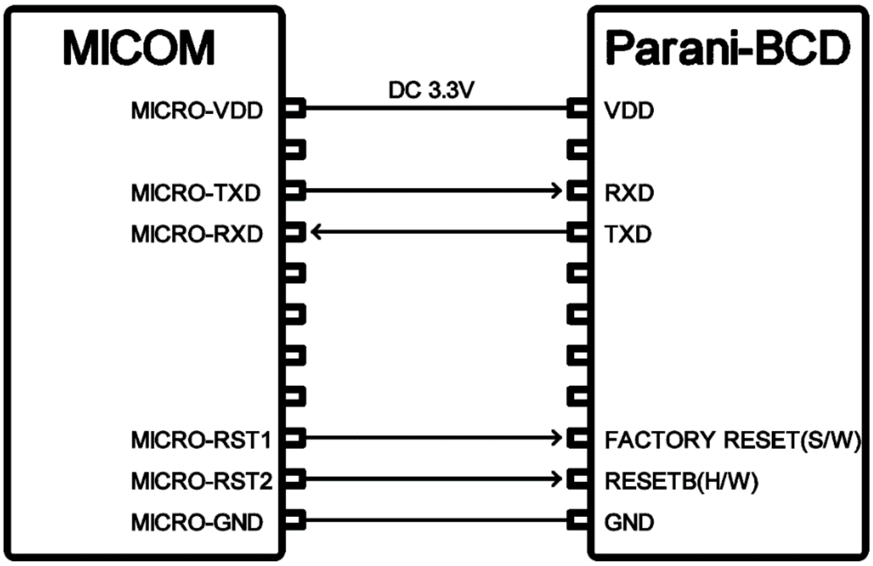
A.2. Connection Diagram

A.2.1. Parani-BCD110V3

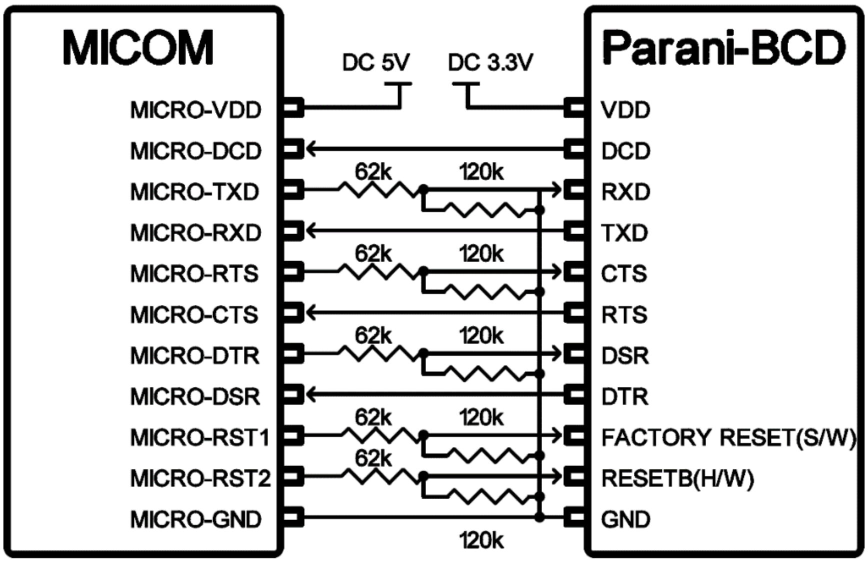
A.2.1.1. When TTL level of MICOM is 3.3V

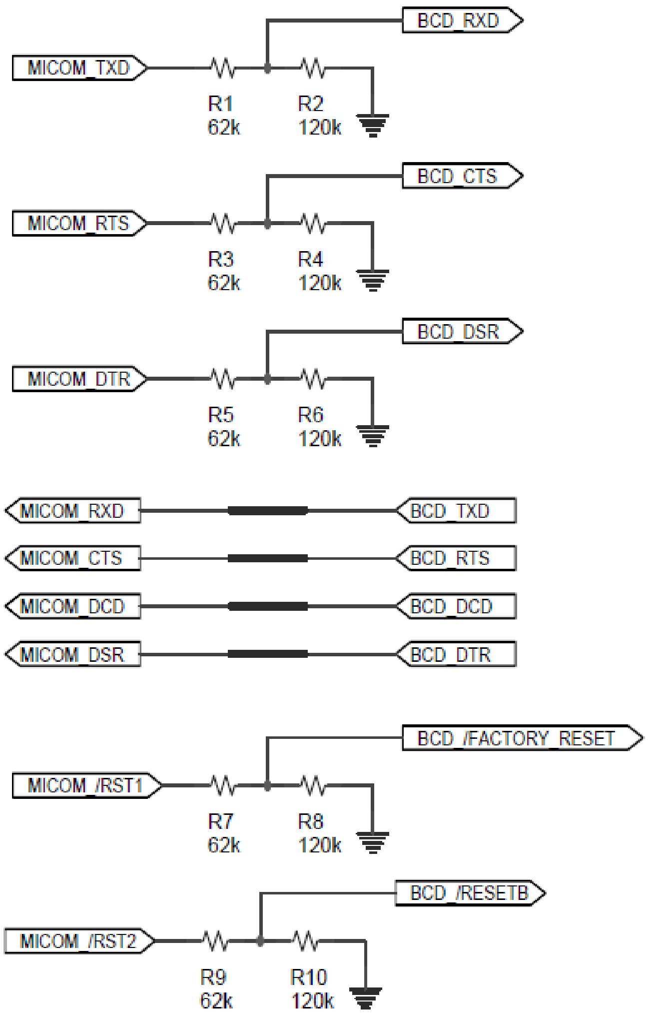


A.2.1.2. When TTL level of MICOM is 3.3V **and Hardware Flow Control is not used**



A.2.1.3. When TTL level of MICOM is 5V





Appendix B: AT Commands

B.1. Terminology

B.1.1. AT Command

AT command set is the in fact standard language for controlling modems. The AT command set was developed by Hayes and is recognized by virtually all personal computer modems. Parani-BCD110V3 provides the extended AT command set to control and configure the serial parameters and Bluetooth connection.

B.1.2. AT Response

Parani-BCD110V3 replies to AT commands with 4 kinds of message, ‘OK’, ‘ERROR’, ‘CONNECT’ and ‘DISCONNECT’. The ‘CONNECT’ / ‘DISCONNECT’ response messages are divided into ‘CONNECT’ / ’DISCONNECT’, ‘SCOCONNECT’ / ’SCODISCONNECT’ and ‘IOPROFILECONNECT’ / ’IOPROFILEDISCONNECT’.

B.1.3. Operation Mode

Mode	Description
Mode0	Waiting for AT commands
Mode1	Attempting to connect to the last connected Bluetooth device
Mode2	Waiting for a connection from the last connected Bluetooth device
Mode3	Waiting for the connection from another Bluetooth device

B.1.4. Operation Status

Status	Description
Standby	Waiting for AT commands
Pending	Executing tasks
Connect	Transmitting data

B.1.5. Security

Security	Description
Authentication	Pin Code (or Pass key)
Encryption	Data encryption

B.1.6. Symbols

The Symbols are used for the description of command syntax as follows:

Symbols	Meaning	ASCII Code
↵	Carriage return	0x0D
↙	Line feed	0x0A
↯	Carriage return + Line feed	
112233445566	Bluetooth device address	
N or m	One digit decimal number	
to	Timeout in seconds	

B.2. Command Category

Command Category		Index	AT Commands
RESET		1 2	ATZ AT&F
SERIAL PORT		3 4 5	AT ATE AT+UARTCONFIG,b,p,s,h
BLUETOOTH	Information	6 7 8 9 10 11	AT+BTINFO? AT+BTINQ? AT+BTLAST? AT+BTVER? AT+BTRSSI,n AT+MLIST?
BLUETOOTH	Mode	12 13	AT+BTMODE,n AT+MULTI,n
BLUETOOTH	Status	14 15 16 17 18 19 20 21	+++ --- AT+SETESC,n ATO AT+BTCANCEL AT+BTSCAN AT+BTSCAN,n,to AT+BTSCAN112233445566,to
BLUETOOTH	Connection	22 23 24 25 26 27	ATD AT+IOCONNECT AT+SCOCONNECT ATH AT+IODISCONNECT AT+SCODISCONNECT

	I/O	28 29 30 31 32 33 34 35 36	AT+IOINFO? AT+SETIO= AT+DIO= AT+DIO? AT+AIO? AT+IOPS= AT+DIOCDS= AT+AIOCDS= AT+IOSYNC=
	Security	37 38 39 40 41	AT+BTKEY=$string AT+BTSD? AT+BTCSD AT+BTFP,n AT+BTSEC,a,e
	Miscellaneous	42 43	AT+BTNAME=$string AT+BTLPM,n
S-REGISTER		44 45 46	AT&V ATSnn? ATSnn=mm
REMOTE CONFIGURATION		47 48 49	AT+PASS="nnnnnnnn" AT+CHPASS="nnnnnnnn" AT+REDISCONNECT

B.3. Command Description

B.3.1. ATZ↵

Response	↵OK↵
Purpose	Software Reset
Description	This has the same effects as Powercycling the unit. This command disconnects any connected Bluetooth device, and stops ongoing tasks. After rebooting, the status will be decided by the preset operation mode. Some AT commands require the ATZ command be run so that the commands can take effect.

B.3.2. AT&F↵

Response	↵OK↵
Purpose	Hardware reset
Description	This has the same effect as initialization by pressing the factory reset button. All parameters are initialized to factory defaults

B.3.3. AT↵

Response	⇋OK⇋
Purpose	Check the connection status with host equipment
Description	Check if the connection to host equipment is operating normally. The serial parameters of Parani-BCD110V3 must be same as those of host equipment. If not, the Parani-BCD110V3 will not respond or 'ERROR' message will appear or an abnormal sequence of strings will appear.

B.3.4. ATEx↵

Response	⇋OK⇋
Purpose	Set serial echo
Parameters	x = 0/1 (Default=0)
Description	Serial echo can be set or changed. If it is set to 1, serial input is echoed.

B.3.5. AT+UARTCONFIG,Baudrate,Parity,Stopbit,Hwfc↵

Response	⇋OK⇋
Purpose	Set Serial parameters
Parameters	Baudrate=1200/2400/4800/9600/14400/19200/38400/57600/115200/230400/460800/921600 (Default=9600) Parity=N/E/O (Default=N) Stopbit=1/2 (Default=1) Hwfc(Hardware Flow Control)=0/1 (Default=1)
Description	The Serial parameters can be set or changed. The factory default is 9600, N, 1, 1. To take effect, the ATZ command must be used or Power cycle of the unit.
Example	AT+UARTCONFIG,115200,N,1,1

B.3.6. AT+BTINFO?↵

Response	⇋112233445566,DeviceName,Mode,Status,Auth,Encryp,FlowControl⇋ ⇋OK⇋
Purpose	Display Bluetooth settings
Description	The current Bluetooth settings are displayed including BD address, Device name, Operation mode, Operation status, Authentication, Data Encryption, and Hardware Flow Control. The initial value of Device name is 'BCD110_v3.0.1-445566'. BCD110 stands for Parani-BCD110, v3.0.1 for the version of firmware, and 445566 for the last 6 digits of BD address. Mode=MODE0/MODE1/MODE2/MODE3 Status=STANDBY/PENDING/CONNECT(NN) Auth=0/1 (Authentication is not activated when 0)

	Encrypt=0/1 (Encryption is not activated when 0) FlowControl=HWFC/NoFC NN in CONNECT (NN) of Status stands for the type of connection and consists of the first letter of SPP, I/O and SCO. (ex. SSI -> connections established in SPP, SCO, I/O profile)

B.3.7. AT+BTINQ?↵

Response	↯112233445566,FriendlyName,CoD↯ ↯112233445566,FriendlyName,CoD↯ ↯112233445566,FriendlyName,CoD↯ ↯OK↯
Purpose	Search Bluetooth devices nearby
Description	The Bluetooth devices in Inquiry scan mode nearby are displayed with their BD addresses, Device names, and Class of device. Maximum 15 devices are scanned for 30 seconds. (Default 30 seconds in S-register 33 and default 15 value in S-register 24)

B.3.8. AT+BTLAST?↵

Response	↯112233445566↯
Purpose	Display the BD address of the last connected device
Description	The Bluetooth device last connected to this Parani-BCD110V3 is displayed with its BD address.

B.3.9. AT+BTVER?↵

Response	↯BCD110_v3.0.1↯ ↯OK↯
Purpose	Display device firmware version
Description	Display device firmware version

B.3.10. AT+BTRSSI,n↵ (Single Connection Mode Only)

Response	↯OK↯ ↯0,255,0,0↯ (repeatedly) (0, LinkQuality, 0, RSSI)
Purpose	Test signal strength
Parameters	n=0: Stop signal strength test n=1: Start signal strength test
Description	When Bluetooth connection is established, you can use this command in Standby status. The signal strength will be displayed repeatedly in order of Status, LinkQuality,

	Status, RSSI. If the LinkQuality is close to 255 and RSSI is close to 0, the signal strength is in good standing.
Example	+++ AT+BTRSSI,1 ↵OK↵ 0,255,0,0

B.3.11. AT+MLIST?↵

Response	↵CURRENT MODE:SINGLE CONNECTION MODE↵ ↵OK↵
Purpose	Display the current multiple connection mode and connected slave's Bluetooth addresses
Description	Display current mode (SINGLE CONNECTION MODE, MULTI-DROP MODE, NODE SWITCHING MODE) and connected slaves' Bluetooth addresses.
예제	AT+MLIST? CURRENT MODE: MULTI-DROP MODE TASK1 – 000195000001 TASK2 – DISCONNECT TASK3 – DISCONNECT TASK4 – 000195000004 TASK5– DISCONNECT TASK6– DISCONNECT TASK7– DISCONNECT

B.3.12. AT+BTMODE,n↵

Response	↵OK↵
Purpose	Set operation mode
Parameters	n=0: MODE0 (Default) n=1: MODE1 n=2: MODE2 n=3: MODE3
Description	When the operation status is 'Pending' currently, change the status to 'Standby' with AT+BTCANCEL prior to this command. To take effect, the ATZ must be executed or Power cycle of the unit.
Example	AT+BTMODE,2 ↵OK↵ ATZ

B.3.13. AT+MULTI,n↵

Response	(n=0) ↵OK↵

	(n=1 or n=2) ↯TASK1 OK↯ TASK2 OK↯ TASK3 OK↯ TASK4 OK↯ TASK5 OK↯ TASK6 OK↯ TASK7 OK↯
Purpose	Set multiple connection mode
Parameters	n=0: Single Connection Mode (Default) n=1: Multi-Drop Mode n=2: Node Switching Mode
Description	Set single connection mode, multi-drop mode or node switching mode.

B.3.14. +++↵

Response	↯OK↯
Purpose	Convert the operation status of 'Connect' to 'Standby'
Description	In 'Connect' status, data from host is transmitted to the other side Bluetooth device, and any AT command is not accepted except this command, which is not echoed on the screen. When Parani-BCD110V3 encounters a character '+' from host, it stops the data transmission and waits for next 2 characters. If the next 2 characters are not '+', it restart to transmit data including the first '+' as well. If so, it converts the operation status to 'Standby'. If the data from host includes '+++', it will convert the operation status to 'Standby'. Notice that Parani-BCD110V3 holds data transmission when it encounters '+', until receiving next character. '+' is an escape sequence character by default, which is changeable by AT+SETESC and stored at S-register 28.

B.3.15. – – –↵

Response	↯OK↯
Purpose	Convert the operation status of 'SPP On-line' to 'Remote Configuration'
Description	Basic operation of '---' is same as that of '+++'. While '+++' converts 'Connect' status to 'Standby' status, '---' converts 'Connect' status to 'Remote Configuration' status. '-' is a Remote Escape Sequence character by default, which is changeable and stored at S-register 71.

B.3.16. AT+SETESC,nn↵

Response	↯OK↯

Purpose	Change the escape sequence character
Description	Escape sequence character set to '+' by default is changeable. The parameter nn must be a printable character.
Example	AT+SETESC,+ ↯OK↯

B.3.17. ATO↵ (ATOx, ATObdaddr)

Response	None
Purpose	Convert the operation status of 'Standby' to 'Connect'
Description	You can convert the operation status of 'Standby' to 'Connect' ready to transmit data. In Node Switching mode, a specific slave can be specified to become an active connection by specifying the connection number or the Bluetooth address.
Example	ATO ATO4 ATO000195000001

B.3.18. AT+BTCANCEL↵

Response	↯OK↯
Purpose	Terminate the current executing task
Description	This terminates a current executing task, such as Inquiry scan and Page scan, then converts the operation status to 'Standby'.

B.3.19. AT+BTSCAN↵

Response	↯OK↯ ↯CONNECT 112233445566↯
Purpose	Wait for inquiry and connection from other Bluetooth devices
Description	This allows the inquiry and connection from the other Bluetooth devices. The operation status will be in 'Pending' after this command. When connection is made and released, the operation status is back to 'Pending'. To convert the operation status to 'Standby' AT+BTCANCEL must be used. This has the same effect as AT+BTSCAN,3,0. When connection is made with other Bluetooth device, response will be 'CONNECT' with its BD address.

B.3.20. AT+BTSCAN,n,to↵

Response	↯OK↯ ↯CONNECT 112233445566↯

	or ↯OK↯ ↯ERROR↯
Purpose	Wait for inquiry and connection from other Bluetooth devices for a given duration
Parameters	n=1: Allows Inquiry scan n=2: Allows Page scan n=3: Allows both of Inquiry scan and Page scan to= Time duration in seconds
Description	For the given to, Parani-BCD110V3 is waiting for the inquiry and connection from other Bluetooth devices. If parameter is set to 0, it will wait forever. When connection is made with other Bluetooth device, response will be 'CONNECT' with its BD address. If there is no connection made within this time duration, response is 'ERROR' and the operation status becomes to 'Standby'.
예제	AT+BTSCAN,2,30

B.3.21. AT+BTSCAN112233445566,to↵

Response	↯OK↯ ↯CONNECT 112233445566↯ or ↯OK↯ ↯ERROR↯
Purpose	Wait for connection by the Bluetooth device with given BD address
Parameters	112233445566=BD address to= time duration in seconds
Description	Parani-BCD110V3 waits to be connected to by the Bluetooth device with the given BD address. If parameter is set to 0, it will wait forever. When connection is made with the Bluetooth device, response will be 'CONNECT' with its BD address. If there is no connection made within this time duration, response is 'ERROR' and the operation status becomes to 'Standby'.
Example	AT+BTSCAN0001950011FF,30

B.3.22. ATD↵ (ATD112233445566)

Response	↯OK↯ ↯CONNECT 112233445566↯ or ↯OK↯ ↯ERROR↯
Purpose	Connect to the last connected Bluetooth device or the specific Bluetooth device with a given BD address in SPP
Parameters	112233445566 = BD address

Description	Parani-BCD110V3 attempts to connect to the last connected Bluetooth device or the Bluetooth device with the given BD address in SPP. To make successful connection, the Bluetooth device must be in Page scan mode. This attempt continues for page timeout at ATD and for 5 minutes at ATD112233445566. If it fails to make connection, response is 'ERROR'. This command does not work in 'Pending' status.
Example	ATD ATD000B530011FF

B.3.23. AT+IOCONNECT↵ (AT+IOCONNECT 112233445566)

Response	↵OK↵ ↵IOPROFILECONNECT 112233445566↵ or ↵OK↵ ↵ERROR↵
Purpose	Connect to the last connected Bluetooth device or the specific Bluetooth device with a given BD address in I/O profile
Parameters	112233445566 = BD address
Description	Parani-BCD110V3 attempts to connect to the last connected Bluetooth device or the Bluetooth device with the given BD address in I/O profile. To make successful connection, the Bluetooth device must be in Page scan mode. This attempt continues for page timeout at AT+IOCONNECT and for 5 minutes at AT+IOCONNECT112233445566. If it fails to make connection, response is 'ERROR'. This command does not work in 'Pending' status. This command does not work when all the DIOs are disabled.
Example	AT+IOCONNECT AT+IOCONNECT0001950011FF

B.3.24. AT+SCOCONNECT↵

Response	↵OK↵ ↵SCOCONNECT↵ or ↵OK↵ ↵ERROR↵
Purpose	Connect to the Bluetooth device with SPP connection in SCO
Description	Parani-BCD110V3 attempts to connect in SCO to the Bluetooth device which is already connected to in SPP. This command is available in single connection mode. If it succeeds to make connection on single attempt, response is 'SCOCONNECT'. Otherwise, it response is 'ERROR'. To make SCO connection, the SCO Enable of S-register 84 of both devices is set as 'Enabled'.
Example	AT+SCOCONNECT

B.3.25. ATH↵ (ATHx, ATHbdaddr)

Response	↯OK↯ ↯DISCONNECT↯
Purpose	Release the current connection in SPP Release all the connections or the specified connection in multiple connection mode in SPP
Description	The current Bluetooth connection is released in single connection mode. It takes about Supervision Timeout (S37) to detect an abnormal disconnection such as power off and moving out of service range. In multiple connection modes, the specific connection can be specified to be disconnected by specifying the connection number or the Bluetooth address. The response message of 'DISCONNECT' may be displayed on disconnection depending on the disconnection condition. You can make it not displayed using S10 register.
Example	ATH ATH1 ATH000195000001

B.3.26. AT+IODISCONNECT ↵

Response	↯OK↯ ↯IOPROFILEDISCONNECT↯
Purpose	Release the connection in I/O profile
Description	The I/O connection is released. It takes about Supervision Timeout (S37) to detect an abnormal disconnection such as power off and moving out of service range. The response message of 'IOPROFILEDISCONNECT' may be displayed on disconnection depending on the disconnection condition. You can make it not displayed using S10 register.
Example	AT+IODISCONNECT

B.3.27. AT+SCODISCONNECT↵

Response	↯OK↯ ↯SCODISCONNECT↯
Purpose	Release the connection in SCO
Description	The SCO connection is released. The response message of 'SCODISCONNECT' may be displayed on disconnection depending on the disconnection condition. You can make it not displayed using S10 register. Though SCO connection is closed, SPP connection is maintained.
Example	AT+SCODISCONNECT

B.3.28. AT+IOINFO?↵

Response	↯IOSETTING : 0000000↯ IOPS : 0↯ DIOCDS : 0↯ AIOCDS : 0,15000,0,15000,0↯ IOSYNC : 00000↯ ↯OK↯
Purpose	Display Bluetooth I/O settings
Description	The current Bluetooth I/O settings are displayed including I/O configuration, Periodic sampling, DIO change detection sampling, AIO change detection sampling and DIO synchronization configuration. IOSETTING=0/1/2/3/4 (I/O configuration value) IOPS=0~3600 (sec) DIOCDS=0/1 (Disabled/Enabled) AIOCDS= (AIO change detection sampling *Refer to B.3.35. AT+AIOCDS) IOSYNC=0/1/2/3 (DIO synchronization configuration)

B.3.29. AT+SETIO=0000000↵

Response	↯ OK↯
Purpose	Set I/O Configuration for AIO and DIO
Parameters	AIO Configuration (Default 0) 0 Disabled 1 Enabled DIO Configuration (Default 0) 0 Disabled 1 Digital input, default PULLDOWN 2 Digital Input, default PULLUP 3 Digital output, default LOW 4 Digital output, default HIGH
Description	The function of AIO and DIO is determined. The changes are applied after software reset.
Example	AT+SETIO=0101234

B.3.30. AT+DIO=↵

Response	↯OK↯
Purpose	Set output values of DIO pins
Parameters	0/1 0 Low 1 High
Description	The output values of DIO pins are set. Changing output value is applied to the DIO pin whose I/O configuration is Digital output.

Example	AT+DIO=00011

B.3.31. AT+DIO?↵

Response	↯DIO : <00000>↯ ↯OK↯
Purpose	Display the current DIO status
Description	The current status of DIO pins can be displayed. When I/O configuration of all the DIO pins is set as 'Disabled, response is 'ERROR'.

B.3.32. AT+AIO?↵

Response	↯AIO0 : <1.2123>↯ ↯AIO1 : <1.0019>↯ ↯OK↯
Purpose	Display the current AIO status
Description	The current status of AIO pins can be displayed in voltage. When I/O configuration of all the AIO pins is set as 'Disabled, response is 'ERROR'.

B.3.33. AT+IOPS=nn↵

Response	↯OK↯
Purpose	Set periodic sampling
Parameters	nn =0~3600 (Default 0) 0 Disabled 1~3600 Sampling Period in second
Description	The digital and analog I/O status of Parani-BCD110V3 can be monitored periodically. This command sets the sampling period in second. Change is applied without rebooting. When I/O configuration of all the I/O pins is set as 'Disabled, the periodic sampling does not work.
Example	AT+IOPS=0

B.3.34. AT+DIOCDS=nn↵

Response	↯OK↯
Purpose	Set DIO changed detection sampling
Parameters	nn = 0/1 (Default 0)

Description	This command sets the DIO change detection sampling. The digital I/O status of Parani-BCD110V3 can be monitored whenever a monitored digital I/O pin changes state. The DIO change detection sampling and the Periodic Sampling can be set and used at the same time. Change is applied without rebooting. When I/O configuration of all the DIO pins is set as 'Disabled, the DIO change detection sampling does not work.
Example	AT+DIOCDS=1

B.3.35. AT+AIOCDS=value,AIO0 Rising edge,AIO0 Falling edge,AIO1 Rising edge,Aio1 Falling edge↵

Response	↯OK↯
Purpose	Set AIO changed detection sampling
Parameters	value = 0~10 (Detection period: 0. Disabled, 1. 100ms, 2. 200ms, … 10. 1000ms) Rising edge = 0~15000 (Unit, 0.1mv) Falling edge = 0~15000 (Unit, 0.1mv)
Description	This command sets the AIO change detection sampling. The analog I/O values of Parani-BCD110V3 can be monitored whenever AIO value falls down below the Falling edge or rises up above the Rising edge. If the Rising edge is greater than the Falling edge, the AIO value will be monitored when AIO value is between the Falling edge and the Rising edge. The AIO change detection sampling and the Periodic Sampling can be set and used at the same time. Change is applied without rebooting. It works when I/O configuration of one or more AIO is set as 'Enabled'.
Example	AT+AIOCDS=1,15000,0,15000,0

B.3.36. AT+IOSYNC=nn↵

Response	↯OK↯
Purpose	Set DIO synchronization
Parameters	nn = 0/1/2/3 (Default 0) 0 Disabled 1 Synchronization input 2 Synchronization output 3 Synchronization input/Synchronization output
Description	This command sets the DIO synchronization configuration. The DIO synchronization works well when both devices with single connection mode are connected in I/O profile.
Example	AT+IOSYNC=0

B.3.37. AT+BTKEY=$string↵

Response	Confirm↯ ↯OK↯
Purpose	Change pin code
Parameters	$*string*= New pin code (Default=1234)
Description	Pin code is a string, which allows up to 16 alpha-numeric characters. Based on this pin code, Parani-BCD110V3 generates a link key which is used in actual authentication process
Example	AT+BTKEY=apple

B.3.38. AT+BTSD? ↵

Response	↯112233445566↯ ↯OK↯
Purpose	Display a list of Bluetooth devices sharing the same pin code
Description	Once a connection is made with a pin code, Parani-BCD110V3 saves the Bluetooth device with its link key, generated by the pin code. The connection to a device listed in Parani-BCD110V3 can be made automatically without the authentication process. The maximum number kept on the list is 8.

B.3.39. AT+BTCSD↵

Response	↯OK↯
Purpose	Clear the list of Bluetooth devices sharing the same pin code
Description	This clears the list of Bluetooth devices linked with the same key in flash memory. To take effect, the ATZ command must be used or Power cycle of the unit.

B.3.40. AT+BTFP,n↵

Response	↯OK↯
Purpose	Set generation of link key every time of connection
Parameters	n=0: Inactivate (Default) n=1: Activate
Description	If n is set to 1, Parani-BCD110V3 asks for the pin code every time a connection is made. This can be used to increase security.

B.3.41. AT+BTSEC,Authentication,Encryption↵

Response	↯OK↯
Purpose	Set authentication and data encryption
Parameters	Authentication=0: Inactivate (Default) Authentication=1: Activate Encryption=0: Inactivate (Default) Encryption=1: Activate
Description	If the authentication is activated, the pin code must be set by AT+BTKEY command. Data encryption cannot be used when authentication is not enabled, i.e. Authentication=0 and Encryption=1 will not work properly.

B.3.42. AT+BTNAME=$string↵

Response	↯OK↯
Purpose	Change device name
Parameters	*$string*= New device name (Default=BCD110_v3.0.1-445566)
Description	Parani-BCD110V3 can have a user friendly name for easy identification. The name allows up to 30 alpha-numeric characters.
Example	AT+BTNAME=My-Parani-BCD

B.3.43. AT+BTLPM,n↵

Response	↯OK↯
Purpose	Set low power mode
Parameters	n=0: Inactivate (Default) n=1: Activate
Description	During no data transmission, Parani-BCD110V3 can be in low power mode to save the power. Low Power Timeout is set to S-register S52. So if low power mode is activated and if there is no data transfer during a period specified in S52, Parani-BCD110V3 will be entered low power mode. Please note that it takes a few seconds to make the Parani-BCD110V3 out of low power mode.

B.3.44. AT&V↵

Response	↯S0:m0;S1:m1; …Sn:mn↯ ↯OK↯
Purpose	Display all the S-registers
Description	All parameters are stored at S-register in flash memory. These values are sustained until hardware reset.

B.3.45. ATSnn? ↵

Response	↯value↯ ↯OK↯
Purpose	Display a given S-register
Parameters	nn= Address of S-register
Description	A specific S-register will be displayed.

B.3.46. ATSnn=mm↵

Response	↯OK↯
Purpose	Change S-register value
Parameters	nn= Address of S-register mm= New value of S-register
Description	Some S-registers are optimized for the overall performance and protected and cannot be changed. When users try to change these S-registers, response is 'ERROR'. For details of S-register, refer Appendix: C.
Example	ATS10=0

B.3.47. AT+PASS=$string↵

Response	Remote Configuration Enabled↯
Purpose	Input password in remote configuration mode.
Parameters	$string= Password (Default=0000)
Description	Input password for authentication in remote configuration mode.
Example	AT+PASS=1234

B.3.48. AT+CHPASS=$string↵

Response	Confirm↯ ↯OK↯
Purpose	Change password used in remote configuration mode.
Parameters	$string= New password
Description	Change password used in remote configuration mode. Password length is up to 8. If password is not set, remote configuration mode does not work.
Example	AT+CHPASS=12345678

B.3.49. AT+REDISCONNECT↵

Response	↯OK↯
Purpose	Close remote configuration mode
Description	This closes remote configuration mode and converts the operation status of 'Remote Configuration' to 'SPP On-line'.

B.4. Command Validity

AT Command	Operation Status		
	Standby	Pending	Connect (Data mode)
ATZ	○	○	
AT&F	○	○	
AT	○	○	
ATE	○	○	
AT+UARTCONFIG,b,p,s,h	◎		
AT+BTINFO?	○	○	
AT+BINQ?	◎		
AT+BTLAST?	○	○	
AT+BTVER?	○	○	
AT+BTRSSI,n	●		
AT+MLIST?	○	○	
AT+BTMODE,n	◎		
AT+MULTI,n	○	○	
+++			●
– – –			●
AT+SETESC	◎		
ATO	●		
AT+BTCANCEL		○	
AT+BTSCAN	◎		
AT+BTSCAN,n,to	◎		

AT+BTSCAN112233445566,to	◎		
ATD	○		
AT+IOCONNECT	○		
AT+SCOCONNECT	●		
ATH	●		
AT+IODISCONNECT	●		
AT+SCODISCONNECT	●		
AT+IOINFO?	○	○	
AT+SETIO=	○	○	
AT+DIO=	○	○	
AT+DIO?	○	○	
AT+AIO?	○	○	
AT+IOPS=	○	○	
AT+DIOCDS=	○	○	
AT+AIOCDS=	○	○	
AT+IOSYNC=	○	○	
AT+BTKEY=nnnn	◎		
AT+BTSD?	○	○	
AT+BTCSD	◎		
AT+BTFP,n	◎		
AT+BTSEC,Auth,Encr	◎		
AT+BTNAME=Name	◎		
AT+BTLPM,n	◎		
AT&V	○	○	
ATSnn?	○	○	
ATSnn=mm	○	○	
AT+PASS=nnnnnnnn	○	○	
AT+CHPASS=nnnnnnnn	○	○	
AT+REDISCONNECT			●

◎ Valid only when Parani-BCD110V3 is not connected to other Bluetooth device.
● Valid only when Parani-BCD110V3 is connected to other Bluetooth device.

Appendix C: S-Register

S-registers contain the parameters for the Parani-BCD110V3. These are stored in flash memory and the values will be saved unless hardware reset is executed. The value of S-register can be accessed and changed with ATS command. Some S-registers not shown below are set to maximize the performance of Parani-BCD110V3. Thus it is not recommended to change these S-registers.
Change the value of S-register only in Standby status and turn Parani-BCD110V3 off and on.

C.1. S1: Force to Reconnect (default 1)

S1=0, Parani-BCD110V3 in Mode1 does not try to reconnect when disconnected.
S1=1, Parani-BCD110V3 in Mode1 keeps trying to reconnect when disconnected.

C.2. S3: Stream UART Policy (default 0)

S3=0, the priority of UART streaming is throughput.
S3=1, the priority is latency, which minimizes the delay of data transmission. This is useful in case of transmitting very small data quickly.
When this value is 1, in order to minimize latency, Parani-BCD110V3 sends the received data immediately. When this value is 0, the Parani-BCD110V3 maximizes throughput, the Parani-BCD110V3 stores received data for a short time and sends a large data packet. If the packet length is less than 100 bytes, having latency being the priority is recommended. If the packet length is more than 100 bytes, having throughput as the priority is recommended. Also, if you want to use high baud rate, throughput priority will be more effective. Just for reference, the buffer length for receiving data is 2 Kbytes.

C.3. S4: Enable Remote Name Query (default 1)

S4=0, Parani-BCD110V3 will query only the BD address. This speeds up the inquiry process.
S4=1, Parani-BCD110V3 will query the BD address, device name and class of device.
When this value is 1, Parani-BCD110V3 finds not only BD address but also friendly name. When this value is 0, Parani-BCD110V3 finds only BD address. When set to 0 this will make queries much faster. When using the pairing button, finding friendly name will be omitted automatically.

C.4. S6: Enable Low Power Mode (default 0)

S6=0, deactivate Low Power Mode.
S6=1, activate Low Power Mode.
This value decides whether Parani-BCD110V3 works in Low Power Mode or not. When this value is 0, Parani-BCD110V3 works only in active power mode. When this value is 1, Parani-BCD110V3 will be in low power mode to save the power. Therefore, it takes a few seconds to wake the Parani-BCD110V3 out of low power mode.

C.5. S10: Enable Response Message (default 1)

S10=0, Parani-BCD110V3 does not send response messages to the host system.
S10=1, Parani-BCD110V3 sends response messages to host system.
This value decides whether Parani-BCD110V3 sends response messages such as OK, ERROR, CONNECT, DISCONNECT or not. When this value is 0, Parani-BCD110V3 will not send any response messages. If the response messages conflicts with your host programs or devices that is connected to PParani-BCD110V3, change this value to 0.

C.6. S11: Enable Escape (default 1)

S11=0, Parani-BCD110V3 does not allow escape sequence characters. The operation status of Connect cannot be changed to Standby. Since the Parani-BCD110V3 skips the process of detecting escape sequence characters, more efficient data transmission can be had.
S11=1, Parani-BCD110V3 allows for the escape sequence character. Whenever it is needed, the Connect status can be changed to Standby.

C.7. S12: Clear Data Buffer When Disconnected (default 1)

S12=0, Parani-BCD110V3 does not clear the data buffer received from host system when disconnected.
S12=1, Parani-BCD110V3 clears the data buffer when disconnected.

C.8. S13: Enable DCD Signal (default 1)

S13=0, DCD signal off
S13=1, DCD signal on

C.9. S14: Enable DTR Transfer (default 1)

S14=0, DTR/DSR signal is transferred in a loop-back fashion.
S14=1, DTR signal is transferred to DSR of remote device.

C.10. S15: Enable Disconnect by DTR (default 0)

S15=0, DTR signal cannot release the connection.
S15=1, The Bluetooth connection can be released when DTR signal is off.
This value decides whether Bluetooth connection is released when DTR signal drops or not. If this value is 1, you can use DTR signal in order to disconnect Bluetooth connection.

C.11. S24: Maximum Number of Inquiry Result (default 15)

The maximum number of inquiry list can be controlled. This value is up to 15.
Because the value 0 means that the maximum number will not be limited, inquiry continues till inquiry timeout elapses or AT+BTCANCLE is executed to cancel inquiry.

* In case of 0, no limit of inquiry device number may cause the lack of memory and reboot Parani-BCD110V3.

C.12. S26: Intercharacter Timeout (default 0)

This value describes time interval between characters used to separate the data from serial port.
If there is no more data coming from serial port in this value, data is sent to client.
The unit of this value is msec and the maximum value is 1000msec.

* When 10 bytes data are sent every intercharacter timeout, they are sent separately by 10 bytes at the optimal value. If the intercharater timeout is set below the optimal value, the data will be put together and sent by 20, 30, 40 bytes or more.

C.13. S28: Escape Sequence Character (default +)

The decimal number of the ASCII code of escape sequence character can be controlled. The initial value is 43, the ASCII code of '+'.

C.14. S31: Page Timeout (default 20)

This is the timeout in seconds to attempt connection with the ATD command. After this timeout expired, the Parani-BCD110V3 will reboot in Mode 1 and it will display 'ERROR' in the other Mode. If this value is 0, Parani-BCD110V3 will attempt to connect continuously.

C.15. S33: Inquiry Timeout (default 30)

This is the timeout in seconds to execute inquiry scan. The range is between 0 and 3600. If this value is 0, Parani-BCD110V3 will execute inquiry scan continuously till the number of inquiry list exceeds the Maximum Number of Inquiry Result or inquiry scan is canceled by committing AT+BTCANCEL command.

C.16. S37: Supervision Timeout (default 5)

This is the timeout to presume disconnection, which is set to 5 seconds initially. The smaller the value becomes, the more quickly Parani-BCD110V3 can detect an abnormal disconnection. But when the communication is suspended, it may be regarded as disconnection. This value should be greater than the Slave Disconnect Timeout (S57). (Slave unit depends on the value of master unit.)

C.17. S43: COD (default 001F00)

This value describes the sort of the Bluetooth device and is editable.

C.18. S44: COD Filter (default 0)

This value is used to filter the sort of the Bluetooth devices on inquiring. All the Bluetooth devices are inquired in case of 0. In case of 3E0100, Bluetooth devices with CoD 3E0100 are inquired.

C.19. S45: Inquiry Access Code (default 0x9E8B33)

Inquiry access code is used during inquiry state. The reserved IAC addresses are 0x9E8B00 ~ 0x9E8B3F. The general inquiry IAC is 0x9E8B33.
Parani-BCD110V3 is able to find the Bluetooth devices that are configured as the same IAC.

C.20. S46: BD Address of Last Connected Device

This saves the BD address of the Bluetooth device connected most recently in single connection mode. This saves the Task1 BD address of the Bluetooth device connected most recently in a multiple connection mode.

C.21. S48: Low Power Max Interval (default 5000)

This is the max interval value to use low power mode, which is set to 5000 initially. (5000 x 625µsec = 3125msec). The maximum value is 8000(5sec).

C.22. S49: Low Power Min Interval (default 4500)

This is the min interval value to use low power mode, which is set to 4500 initially. (4500 x 625µsec = 2812msec) The value should be smaller by 150 than the Low Power Max Interval.
A small interval increases power consumption, a large interval increases latency.

C.23. S52: Low Power Timeout (default 5)

This is the low power timeout value, which is set to 5 initially. (5sec)
During no data transmission in the timeout, Parani-BCD110V3 will be in low power mode to save the power. Therefore, it takes a few seconds to wake the Parani-BCD110V3 out of low power mode.

C.24. S54: BD Address of Last Connected Device

This saves the Task2 BD address of the Bluetooth device connected most recently in a multiple connection mode.

C.25. S55: BD Address of Last Connected Device

This saves the Task3 BD address of the Bluetooth device connected most recently in a multiple connection mode.

C.26. S56: BD Address of Last Connected Device

This saves the Task4 BD address of the Bluetooth device connected most recently in a multiple connection mode.

C.27. S57: BD Address of Last Connected Device

This saves the Task5 BD address of the Bluetooth device connected most recently in a multiple connection mode.

C.28. S58: BD Address of Last Connected Device

This saves the Task6 BD address of the Bluetooth device connected most recently in a multiple connection mode.

C.29. S59: BD Address of Last Connected Device

This saves the Task7 BD address of the Bluetooth device connected most recently in a multiple connection mode.

C.30. S60: Slave Disconnect Timeout (default 3)

This S57 register value defines the time period in seconds that a master unit waits in case a slave unit does not receive the data sent from the master. For this time period, the master unit will not send data to all slave units if any slave unit does not receive the data. If the slave unit does not receive the data after this time period elapses, the master unit will disconnect the connection with the problematic slave unit. The value should be greater than 0 and smaller than the Supervision Timeout (S37).

C.31. S61: MAX TX POWER (default 0)

This value describes the peak output power. This Setting is applied after rebooting. (There is a little deviation according to the devices.)

설정 값	dBm
0	Use chip setting.
1	-6
2	-3
3	0
4	3
5	6
6	10
7	14
8	18

C.32. S63: Reconnect Time Interval (default 20)

This value defines reconnect time interval in case a slave is disconnected in multiple connection mode. The actual reconnect time interval will be the value multiplied by two in seconds. For example, if the value is set to 5, the reconnect time interval will be 10 seconds. The value should be greater than or equal to 20. The master unit will only try to reconnect when its mode is set to Mode1.

C.33. S71: Remote Escape Sequence (default 45)

The decimal number of the ASCII code of remote escape sequence character can be controlled. The initial value is 45, the ASCII code of '-'.

C.34. S72: BD Address of Last Connected I/O Device

This saves the BD address of the Bluetooth device connected most recently in I/O profile. This address is used when I/O connection is attempted using AT+IOCONNECT command.

C.35. S82: Enable Deep Sleep (default 0)

S82=0, Deep Sleep Disable
S82=1, Deep Sleep Enable
If Deep Sleep is enabled and there is no data transmission in 1 second, Parani-BCD110V3 will be in Deep Sleep. Data transmission will wake up Parani-BCD110V3 in Deep Sleep.

* While quiescent current in Standby status where Parani-BCD110V3 do not anything is about 1.24mA, quiescent current in Deep Sleep status is about 0.02mA. Users need to know that there is data loss when Parani-BCD110V3 comes out of Deep Sleep.

C.36. S84: Enable SCO (default 0)

S84=0, Deep Sleep Disabled
S84=1, Deep Sleep Enabled
This sets SCO operation. Default value is '0' meaning SCO is disabled. If SCO is enabled, SCO connection is also attempted when SPP connection is established in Mode 1.
SCO connection is available when the SCO Enable of both devices is set as 'Enabled'.

Appendix D: Trouble Shooting

D.1. No Data Transmission

D.1.1. Device Settings

Check whether the Baud rate of Parani-BCD110V3 matches that of its host equipment.
Check whether the host equipment of Parani-BCD110V3 uses Hardware Flow Control. Parani-BCD110V3 is initially set to Use of Hardware Flow Control. If your host equipment does not use Hardware Flow Control, please disable the Hardware flow control option by ParaniWIN or AT command.

D.2. Data Loss or Malfunctioning

D.2.1. Hardware Flow Control

When transmitting large amounts of data with No Hardware Flow Control, Parani-BCD110V3 may clear the data buffer unexpectedly. The possibility becomes greater as the RF transmission environment becomes worse.

D.2.2. Response Message

The messages of Parani-BCD110V3 response may affect the function of host system. Set ATS10=0 not to send Parani-BCD110V3 response to host system and try again. Refer Appendix B. for details.

D.3. Transmission Delay

D.3.1. RF Processing Delay

It takes 30msec approximately for a Parani-BCD110V3 to complete a data transmission to the other Bluetooth device. This time delay cannot be reduced and may enlarge as the RF transmission environment becomes worse. Do not use Parani-BCD110V3. If your applications cannot allow for this time delay.

D.3.2. RF Transmission Environment

If there are many Bluetooth devices working in a small area and/or the RF communication distance is too great and/or there are some obstacles affecting RF performance, the Parani-BCD110V3 repeats the transmission packet by packet due to interferences and/or low RF performance. This may lead to increased data transmission time delays.

Appendix E: Warranty

E.1. GENERAL WARRANTY POLICY

Sena Technologies, Inc. (hereinafter referred to as SENA) warrants that the Product shall conform to and perform in accordance with published technical specifications and the accompanying written materials, and shall be free of defects in materials and workmanship, for the period of time herein indicated, such warranty period commencing upon receipt of the Product.

This warranty is limited to the repair and/or replacement, at SENA's discretion, of defective or non-conforming Product, and SENA shall not be responsible for the failure of the Product to perform specified functions, or any other non- conformance caused by or attributable to: (a) any misapplication or misuse of the Product; (b) failure of Customer to adhere to any of SENA's specifications or instructions; (c) neglect of, abuse of, or accident to, the Product; or (d) any associated or complementary equipment or software not furnished by SENA.

Limited warranty service may be obtained by delivering the Product to SENA or to the international distributor it was purchased through and providing proof of purchase or receipt date. Customer agrees to insure the Product or assume the risk of loss or damage in transit, to prepay shipping charges to SENA, and to use the original shipping container or equivalent.

E.2. LIMITATION OF LIABILITY

EXCEPT AS EXPRESSLY PROVIDED HEREIN, SENA MAKES NO WARRANTY OF ANY KIND, EXPRESSED OR IMPLIED, WITH RESPECT TO ANY EQUIPMENT, PARTS OR SERVICES PROVIDED PURSUANT TO THIS AGREEMENT, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. NEITHER SENA NOR ITS DEALER SHALL BE LIABLE FOR ANY OTHER DAMAGES, INCLUDING BUT NOT LIMITED TO DIRECT, INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, WHETHER IN AN ACTION IN CONTRACT OR TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY), SUCH AS, BUT NOT LIMITED TO, LOSS OF ANTICIPATED PROFITS OR BENEFITS RESULTING FROM, OR ARISING OUT OF, OR IN CONNECTION WITH THE USE OF FURNISHING OF EQUIPMENT, PARTS OR SERVICES HEREUNDER OR THE PERFORMANCE, USE OR INABILITY TO USE THE SAME, EVEN IF SENA OR ITS DEALER HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT WILL SENA OR ITS DEALERS TOTAL LIABILITY EXCEED THE PRICE PAID FOR THE PRODUCT.

E.3. HARDWARE PRODUCT WARRANTY DETAILS

WARRANTY PERIOD: SENA warranties embedded hardware Product for a period of one (1) year, and external hardware Product for a period of three (3) or five (5) years according to the Product type.

WARRANTY PROCEDURE: Upon return of the hardware Product SENA will, at its option, repair or replace Product at no additional charge, freight prepaid, except as set forth below. Repair parts and replacement Product will be furnished on an exchange basis and will be either reconditioned or new. All replaced Product and parts become the property of SENA. If SENA determines that the Product is not under warranty, it will, at the Customers option, repair the Product using current SENA standard rates for parts and labor, and return the Product at no charge in or out of warranty.

WARRANTY EXCLUSIONS: Damages caused by
- Accidents, falls, objects striking the SENA product,
- Operating the Product in environments that exceed SENA's temperature and humidity specifications,
- Power fluctuations, high voltage discharges,
- Improper grounding, incorrect cabling,
- Misuse, negligence by the customer or any other third party,
- Failure to install or operate the product (s) in accordance to their SENA User Manual,
- Failure caused by improper or inadequate maintenance by the customer or any other third party,
- Floods, lightning, earthquakes,
- Water spills,
- Replacement of parts due to normal wear and tear,
- Hardware has been altered in any way,
- Product that has been exposed to repair attempts by a third party without SENA's written consent,
- Hardware hosting modified SENA Software, or non-SENA Software, unless modifications have been approved by SENA.
- Battery component capacity degradation due to usage, aging, and with some chemistry, lack of maintenance.

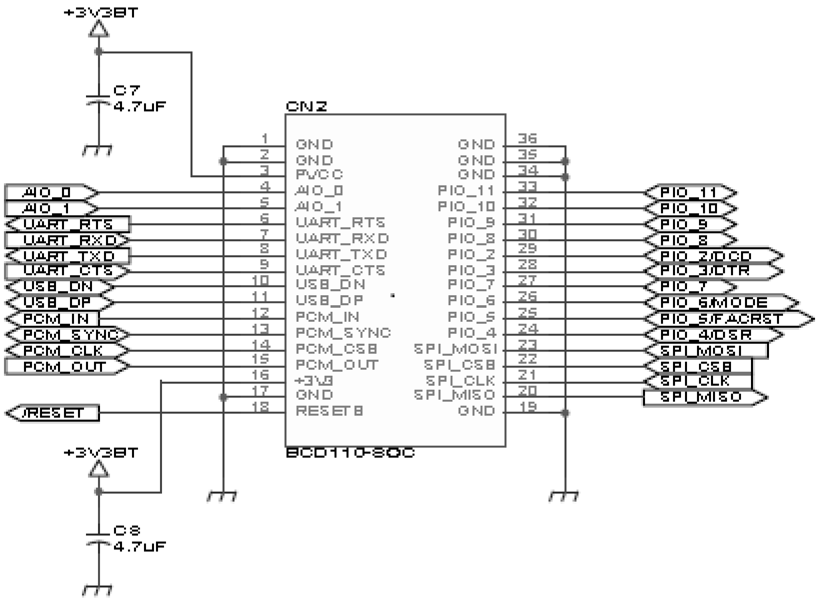
E.4. SOFTWARE PRODUCT WARRANTY DETAILS

WARRANTY PERIOD: SENA warranties software Product for a period of one (1) year.
WARRANTY COVERAGE: SENA warranty will be limited to providing a software bug fix or a software patch, at a reasonable time after the user notifies SENA of software non-conformance.

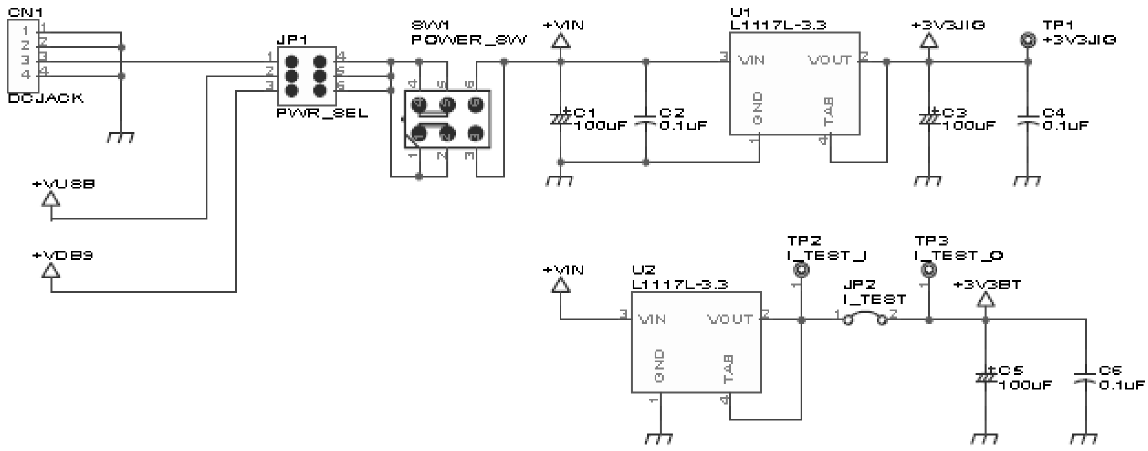
E.5. THIRD-PARTY SOFTWARE PRODUCT WARRANTY DETAILS

The warranty policy of the third-party software is conformed to the policy of the corresponding vendor

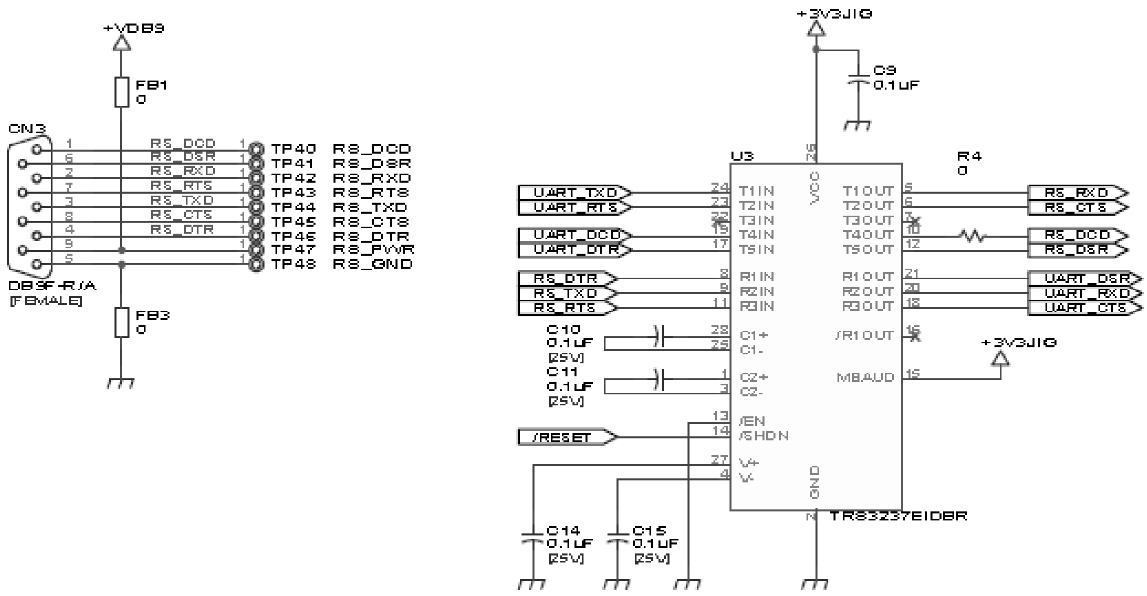
Appendix F: How to make a Development Board



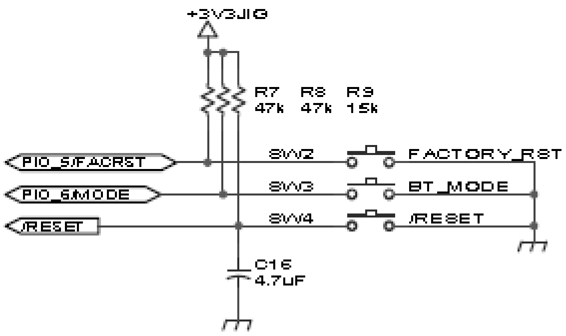
[BT Module Interface]



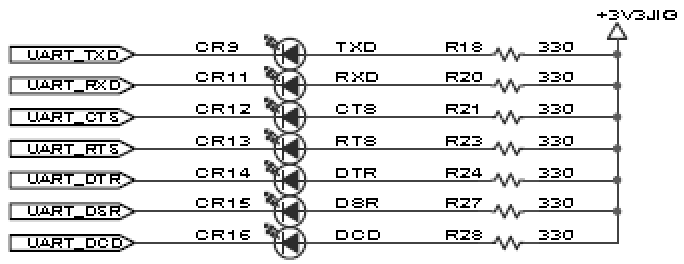
[Power and Reset Interface]

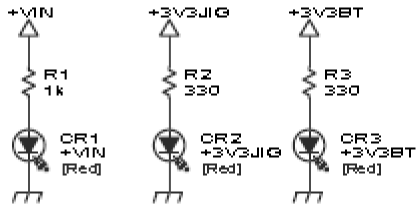


[RS232 Serial Interface]

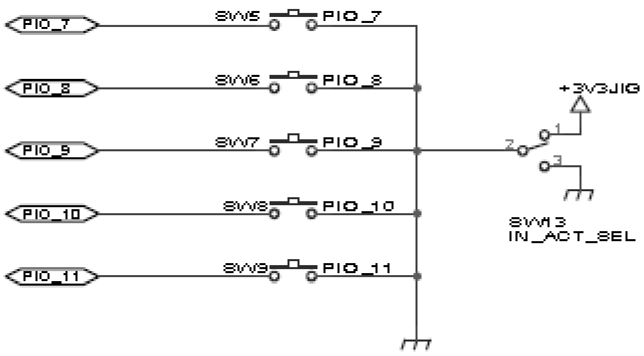


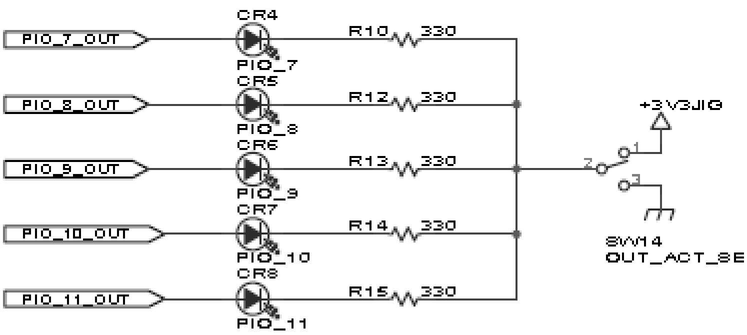
[Switch Interface]



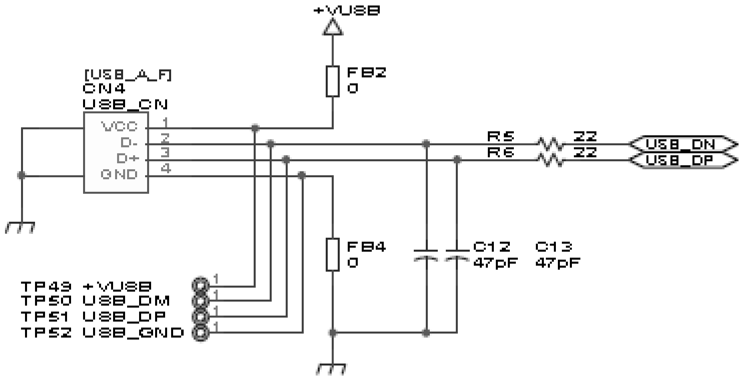


[LED Interface]

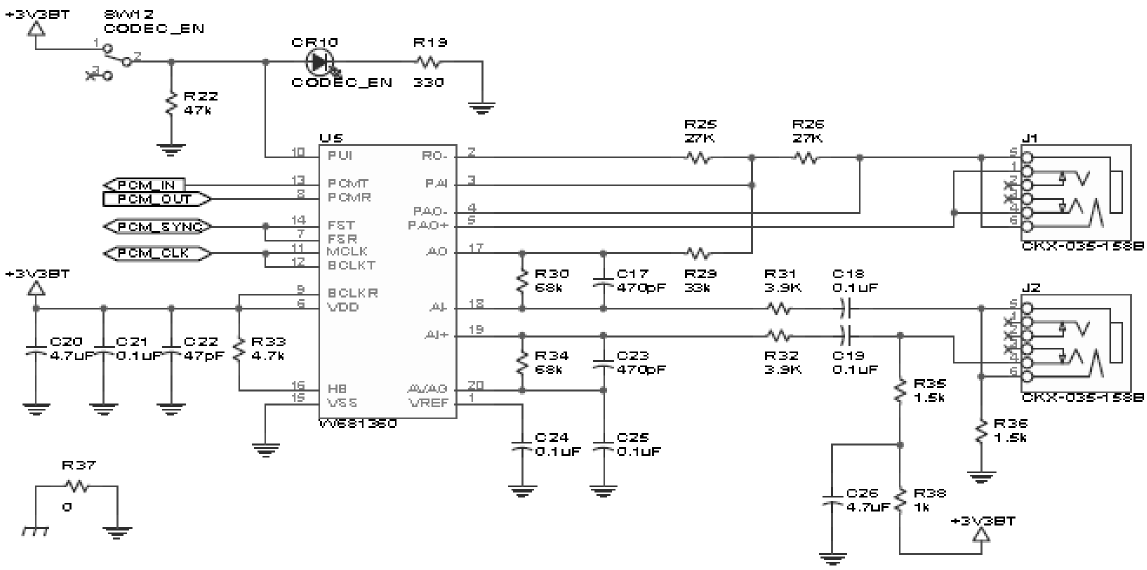




[GPIO Interface]

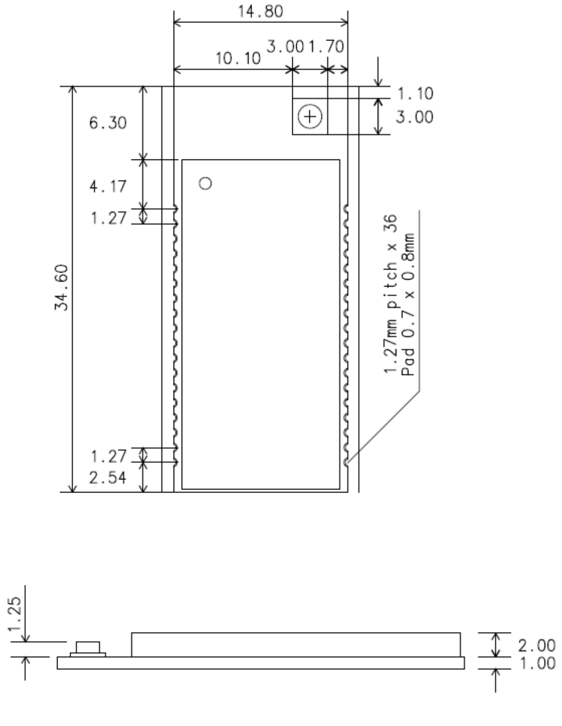


[USB Interface]

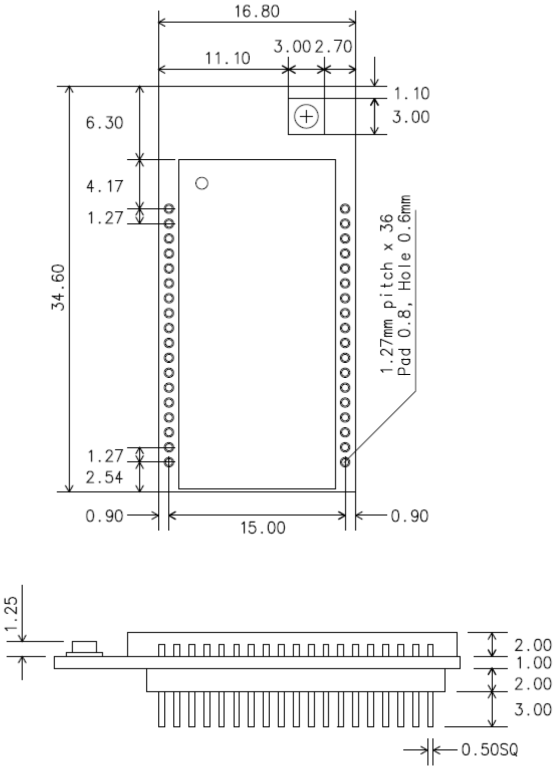


[PCM Interface]

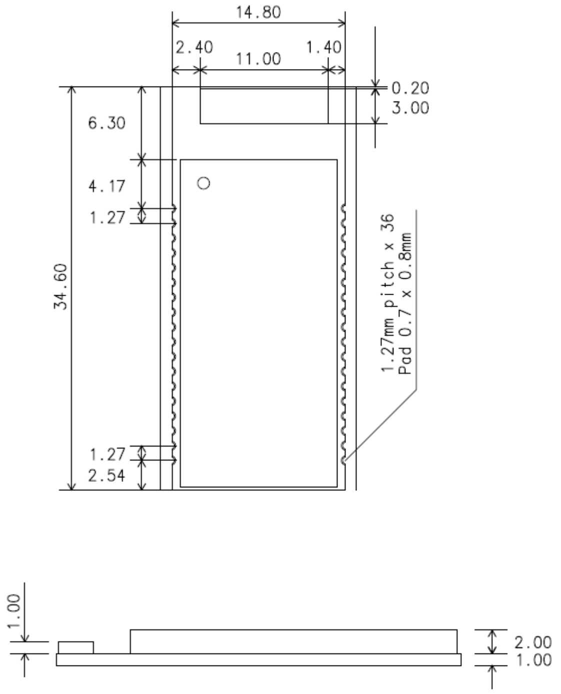
Appendix G: Parani-BCD110 PCB mechanical drawing



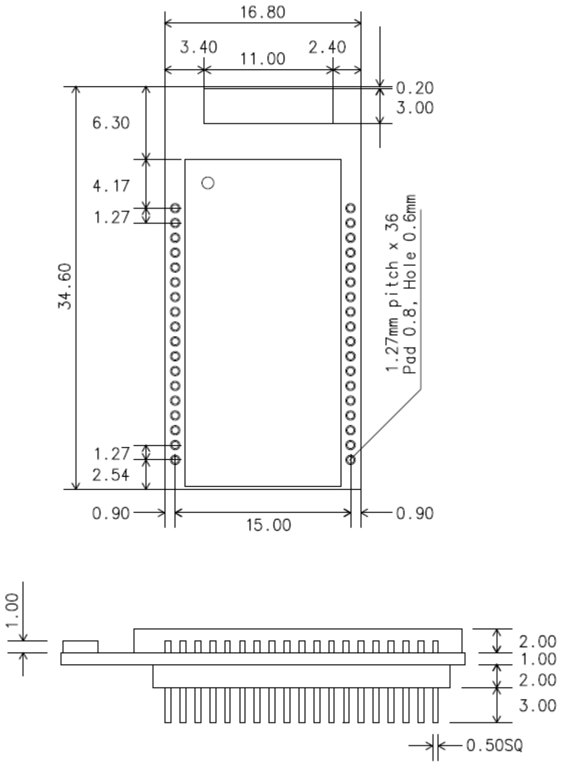
[BCD110SU]



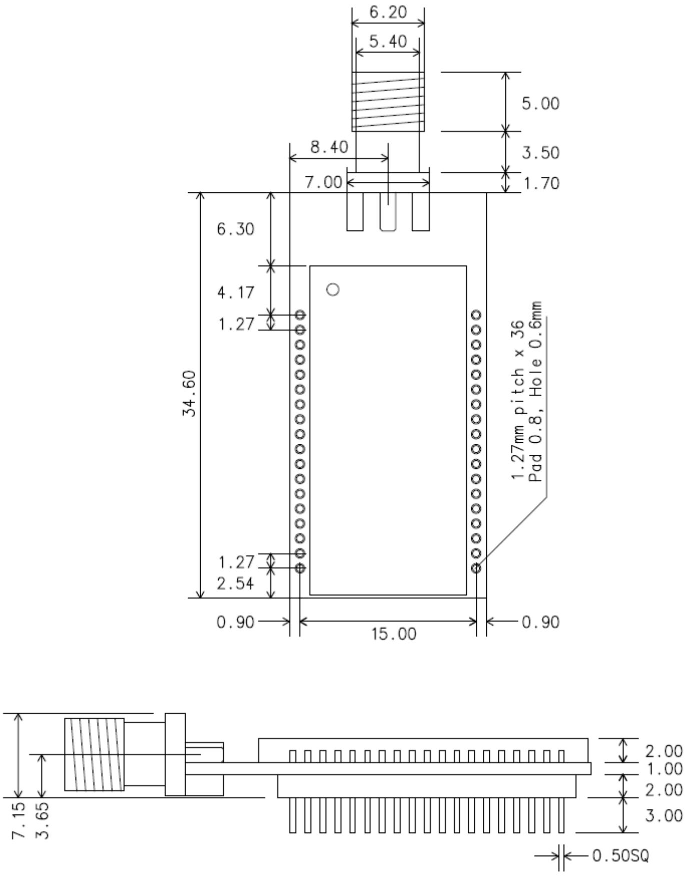
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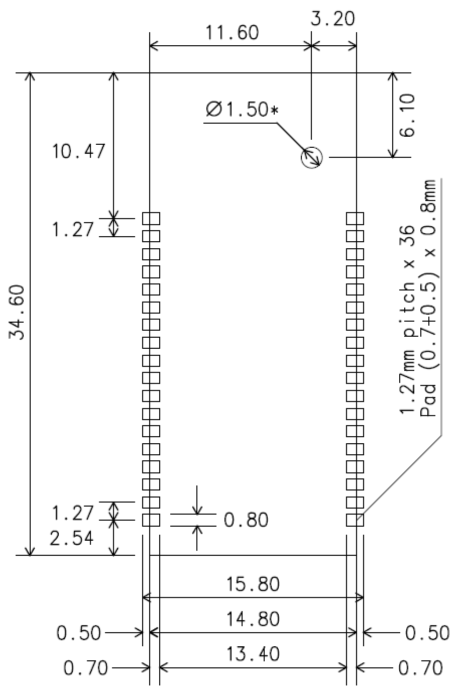
[BCD110SC]



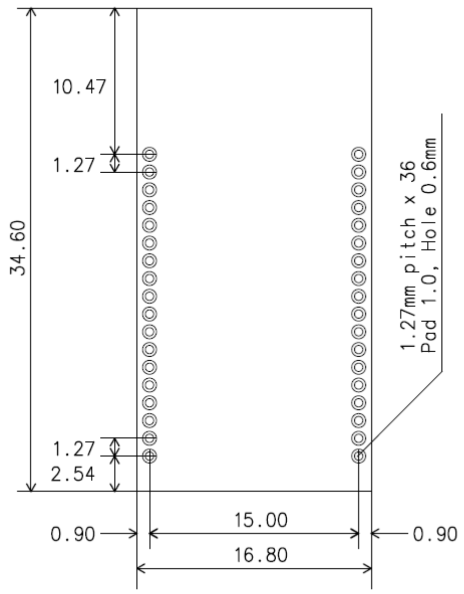
[BCD110DC]



[BCD110DS]



[SMD Type]



[DIP Type]